Man and the Motor Car

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MAN and the MOTOR CAR

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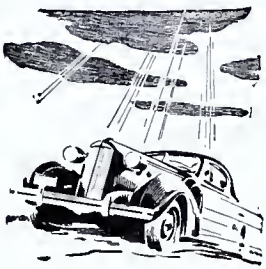

Edited and with an Introduction by

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PREFACE

SO many persons have had a hand in the making of this book that it has seemed necessary to have it sponsored by an "editor" rather than by an "author."

The need for such a book as this has been largely due to the enthusiastic and untiring work of Herbert J. Stack in getting high schools to put in good driving courses.

The main work of mapping out the project, of assembling material and of organizing it in a comprehensive plan was done by William Wattenberg with the help of J. W. A. Brown.

The writing of the book in its final form, as well as much of the organizational work, was done by Robert Monaghan.

The illustrations and the typographical arrangement are by S. Garnett Goesle.

In the planning and development of the book, we have had the valuable assistance of an Advisory Council made up of the following:

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The members of the Advisory Council have served without compensation.

We are indebted to many other people who have helped in the reading of manuscript, and in various other ways, and to these we express our great appreciation and thanks for such help.

A. W. W.

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INTRODUCTION

THE man of today probably travels at least a hundred times as far during his lifetime as the man of fifty years ago. This change has come about mainly through the use of the automobile,—it has brought us mobility and all but freed us from the limitations of time and place.

A knowledge of this remarkable machine and of the way in which it has influenced our life and culture would be worth having in and for itself. This book is written, however, for a more explicit purpose.

With the automobile has come the problem of moving traffic efficiently and expeditiously and the still more serious problem of moving it safely. These are problems that affect everybody. The automobile touches the intimate life of every family, partly because its use has become so universal and partly because we are still faced with carrying on the not yet extinct art of pedestrianism.

We have shown little fighting spirit in the face of the hazard that the automobile has created,—perhaps because we have not been willing to discipline ourselves, perhaps because we have felt that the pleasure and convenience that it has brought us was something that we could not have except at a price. Such an

attitude has no place in our modern civilization. This is not the age of resignation; we do not have to submit to evils today; we can conquer them.

Electricity and steam are full of potential dangers, and yet we have learned how to use them with almost complete safety. The railroad once had almost as shocking a record as the automobile, but today one might ride on a train continuously night and day for a thousand years without exhausting his expectancy of living.

We may learn a lesson from industry. Twenty-five years ago, accident conditions in industry were as intolerable as they are in the case of traffic today. Many establishments have now succeeded in reducing their accidents eighty and ninety percent, and with this has come increased efficiency. The airplane was dangerous and undependable at first. It has now become a reasonably safe form of transportation.

Making motor traffic safe is doubtless more intrinsically difficult than making industry or the railroad or the airplane safe. Yet some communities have already gone a long way toward such an accomplishment, and these communities feel that they have only begun on the job. There has been conspicuous

improvement in the case of commercial vehicles, where the driver has been made to feel the force of executive authority. Safety education in the schools has produced still more remarkable results.

The difficulty is that, up to the present time, we have treated the problem with indifference. Essential as it is, for example, that the motorist should be made legally responsible for the quality of his driving, only ten states have laws that accomplish this in a reasonably satisfactory way. Nearly half of the states have no laws at all. Making traffic safe is no easy job, but it is a job that can be done if we care enough about it to make the necessary effort. This is not the place to speak of how this result can be had. All that can be done here is to explain the particular approach to the problem that accounts for the preparation of this book.

One of the ways, and the most important way, of making traffic safe is by improving the quality of our drivers. A man is not allowed to become a locomotive engineer until he has had several years of experience as a fireman. A man is not allowed to fly an airplane until he has had competent instruction and has qualified as a pilot. In some of our states, however, a child that can steer a scooter can legally drive

a hundred horse power car on a crowded thoroughfare, and in no state has any organized provision been made for seeing that people, and particularly young people, are taught how to drive.

If we are seriously to attack our traffic problem, this condition cannot be allowed to continue. Somewhere in our social or educational system a place must be found where responsibility can be definitely established for teaching young people how to use the automobile. The natural place for the giving of such instruction is the high school, and during the past year hundreds of high schools have accepted this responsibility and are now giving such courses. It seems reasonable to believe that only a few years will go by before every high school in the country will be undertaking such work.

This book has been written in response to a demand from high schools for a text book for use in such classes. It has been purposely designed, also, to meet the needs of anyone who wants to know about the automobile and how to use it. While the chief emphasis is upon the art of driving, the book is by no means merely a manual of good driving. If a course on the automobile is to find and retain a place in the high school curriculum, it must undoubtedly

fall within the field of the social studies; it must present the automobile in its relationship to our modern civilization, and it must prepare the high school student to meet the various problems that the automobile has created. While the most immediately important and the most universal problem is driving, there are many others that must be recognized. One of these at the opposite extreme is the building of roads and highways for automobile traffic in such a way that they will not deface the natural beauty of the country, so that we may avoid what happened at the advent of the railroad.

Some high school students will become traffic policemen, others will become highway engineers and traffic engineers, others will become legislators, mayors of cities, judges and governors. All these will need to have a comprehensive view of the place of the automobile in our civilization and of the problems that it has introduced. All this knowledge will be equally desirable if the student is only to be made into an intelligent and right-minded citizen, one who will observe the traffic rules and will not try to get tickets "fixed" when he gets into trouble.

It is interesting and significant that the demand for such a book should come at a time when the

secondary schools are acutely feeling the need for a revision of the curriculum that will bring their work into closer relationship with the practical problems of living. Could there be a more pressing and opportune demand upon the high schools than this call for help from a world that sorely needs to find a way to make the automobile its servant instead of its master?

ALBERT W. WHITNEY.

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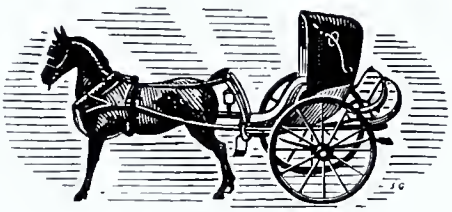
A NATION ON WHEELS



Fifty years ago "Thanks for the buggy ride" wasn't a wisecrack; it was an expression of genuine gratitude. For man moved about this vast continent in a variety of interesting but uncomfortable ways—on horseback, in coaches, wagons and shays; on slow, smoky railroads; on river steamers, rafts and canalboats. A ride in a buggy was a luxury. The fastest vehicle for the casual traveler was the bicycle—itself a new, an awkward and a hazardous contraption.

"Carriage folk" with their private rigs were the wealthy, the socially élite. To them the owning and breeding of fine horses was a matter of honor, the tradition of centuries. All the world respected the horse as an indispensable figure in civilization, and even the poorest man treated himself to a holiday, when he could manage it, by hiring a horse and carriage from one of the many livery stables that flourished throughout the land. Yet to everyone a trip of fifty miles by private carriage meant hours of jolting over dusty, undependable and often treacherous roadways. It was an adventure not to be taken lightly or without proper preparation.

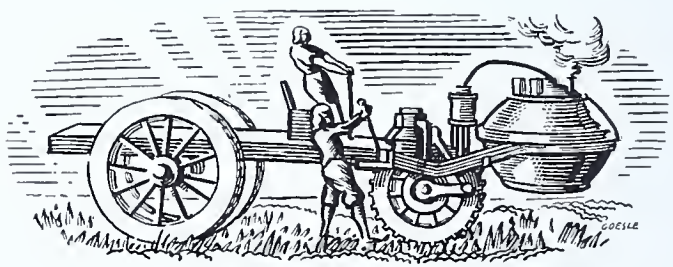
In this era the automobile was a vague, undigested idea—a dream dreamt only by ambitious and visionary

tinkerers. Yet of such there were many; generations of them had struggled to perfect a vehicle that would move itself on land, and that would be available to the great masses of people. The invention of the locomotive in 1814 was the first successful sweep forward in the direction of fast, comfortable transport. But the locomotive was not a complete solution; it was not something every man could own and operate at his convenience. With the railroad train man had to adjust himself to the limitations imposed by time-tables and fixed tracks. Passengers and freight of necessity must be taken on and put off at one spot—the depot. Thus the urge for an "automobile," a self-moving vehicle for the masses, goaded inventors on and on.

So it was that when a motor car constructed by Charles A. Duryea defeated another built by Elwood Haynes in a race at the World's Fair in Chicago in 1893 a new age in human mobility surged forward. By 1933 there were thirty-three million automobiles in the world,—seventy two percent of them in the United States.

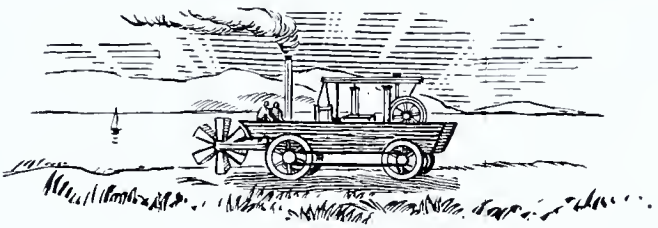
THE FIRST AUTOMOBILES

Duryea's car built in 1892 was not the first. In 1770, a Frenchman, named Nichola Cugnot, constructed a steam carriage to be used as a cannon-hauling tractor. Heavy and awkward, it could negotiate a top speed of



two and one-half miles an hour, but was forced to stop every few hundred feet so that its boilers might generate more steam. It made only one trip. On its second it overturned, and poor Cugnot fled into exile, disgraced.

About thirty-five years later Philadelphians were startled one day at the sight of a steam-propelled monster moving through their streets. It was the twenty-one ton *Orukter Amphibolis* built by Oliver Evans. Evans in-



tended his machine to move both on land and on water; he had mounted a flat boat on wheels and adjusted an engine so that it would not only turn the wheels but also a paddle wheel at the stern. The land activities of the *Orukter Amphibolis* failed, and thereafter its adventures were confined to water.

By the middle of the nineteenth century, however, movement in steam automobiles was reasonably successful, particularly in Europe. And yet, the vehicle itself was not satisfactory, being heavy and clumsy, expensive to build and difficult to operate. A driver, before starting, lighted a fire under a large, ponderous boiler; and yet it was half an hour or more later before sufficient steam was generated so that the car could move. Because of its dependence on fire for motion, the steam automobile was regarded as a fire menace, and, because the iron tires of its enormous wheels played such havoc with roadways, as something of a destructive nuisance. The result was that England passed legislation restricting its use, laws which

had the effect of crippling the early development of the motor car there.

It now became evident that what the automobile needed to make it a success was a light engine which could be started with a minimum of effort. Internal combustion engines, forerunners of those used in our modern motor cars, were not long in appearing. After 1866 one type of engine followed another until in 1885, Gottlieb Daimler, a German, built an engine which derived its motive power from the burning of a mixture of kerosene vapor and air within a cylinder. Daimler used his engine on a bicycle.

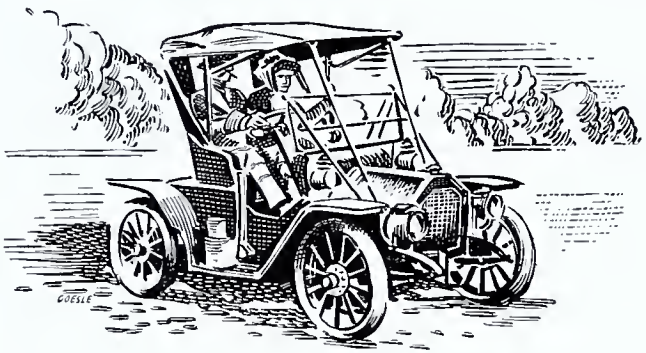
In the same year another German named Benz built the first motor automobile in Mannheim, and then drove it through the streets of Munich. His car was a three wheeled affair, capable of a speed of ten miles an hour. Its use was restricted to a few streets out of fear that it would frighten horses.

Now that the fundamental principles had been established men set feverishly to work to put them into practice. Improvements followed each other in rapid succession, and forward strides were made even in the use of the steam engine so that for a time it definitely challenged the gasoline engine as the basis for automobile power. In the meantime a successful electric automobile was constructed by William Morrison in Des Moines, Iowa. But the gasoline engine continued to demonstrate its superiority and engineers concentrated on its development. It was more powerful than any electric motor that could be designed for automotive use, and it was simpler to start and to operate than the steam engine. Fuel was cheaper, easier to obtain and easier to carry.

In the beginning, automobiles were little more than motorized buggies and they thoroughly deserved the name "horseless carriages." Their bodies were built to order by carriage manufacturers who designed them so that the

engine could be placed either under the carriage or directly behind the driver's seat. The wheels which were large and high were connected with the engine by a system of chains and belts. Over the passenger's seat there was either a flimsy wagon top or no covering at all. They were makeshifts, clumsy and ungraceful in appearance, so much a product of the horse-and-buggy age that one early model was even equipped with a whipsocket!

Moreover, these early cars were expensive and unreliable. Unusual physical effort and a considerable knowledge of mechanics were required to operate them safely. The self-starter had not yet appeared, and cranking a car to get it started, involved both strain and danger. A motorist, hot and perspiring over the crank of a balky engine, was a sight to provoke laughter and gibes from passersby. He would set a few levers, turn the crank several times, and then, when the engine appeared to start, dash to the driver's seat frantically to manipulate



whatever controls would keep it going. More likely than not, the engine would gasp, stop dead, and the procedure would have to be repeated again and again. In the midst of this cranking the engine would often backfire, spinning the crank backward, sometimes throwing the cranker flat, and sometimes breaking his arm.

In this day the science of manufacturing strong, flexible metals had by no means approached perfection. Metal automobile parts were easily damaged and often broken. It was not unusual, for example, for an axle, a steering gear, a brake or some other vital part to snap under strain. Such a lack of durability called for frequent repairs which were not only expensive but difficult to obtain. Garages and skilled mechanics were scarce, and every motorist perforce was his own mechanic. A large toolbox equipped with a bulky assortment of wrenches and screwdrivers was a standard accessory to every motor car. Early motorists spent a large part of their motoring time under instead of inside their cars, and they were a favorite subject for jokes and banter. Shouts of "Get a Horse" or "Red Devil! Red Devil!" would follow a driver up the street, and even as late as 1913 "Get Out and Get Under" was the title of a popular song. Indeed not a few people were convinced that anyone who owned or rode in an automobile was either a fool or belonged in an asylum.

Tires and fuel were distressing problems in these early days. Rubber manufacture was an infant industry, and rubber tires were consequently unreliable. Punctures and blowouts were so numerous that each car usually carried two spare tires, some as many as four, and every motorist owned a complete patching equipment. The job of changing a damaged tire was considerably more difficult, dirty and exasperating than it is today. After jacking up the wheel, one had to pry the tire loose from the wheel rim, and force another one on. Then the tire had to be inflated with a hand pump. Often a tube had to be patched on the road.

Gasoline was neither dependable nor easily accessible. The refining of petroleum for automobile consumption had hardly started and the service station as we know it today was non-existent. Gasoline was used principally

for cleaning purposes and was available chiefly at hardware establishments or at the country general stores. It was an inferior grade, and the wise motorist carried a fine sieve or a piece of chamois to filter out dirt and water. The quality was so poor that valves had to be ground every few thousand miles, because of the heavy deposits of carbon.

Such troubles were legion, but perhaps the worst of all the motorist's difficulties were the roads. According to legend, most American highways developed out of cow paths, and, following the inclination of cattle, wandered haphazardly where there was least resistance. Hardly suitable for horse-and-wagon traffic, they were now asked to answer the more exacting demands of motor cars. It is not surprising that they failed, for they were nearly all constructed of dirt, and full of ruts, bumps and mudholes. Even the more heavily traveled roads were narrow and high-crowned, that is high in the center, so that when it rained, water flowed off forming boggy side ditches. Minor roads were nothing more than wagon tracks with a lane of grass, boulders or rocks down the middle. In wet weather these highways were sticky as glue, a trap for both car and carriage; in dry weather, they were arid areas where a motor car or a wagon churned up clouds of choking dust.

Such conditions called upon the motorist for a special costume. Men wore linen "dusters" which were long, smock-like garments made to cover their outer clothes, huge driving gloves or gauntlets and large linen caps. Women dressed themselves in similar coveralls, wearing in addition, over their large hats a voluminous chiffon veil firmly tied under the chin. All were equipped with goggles.

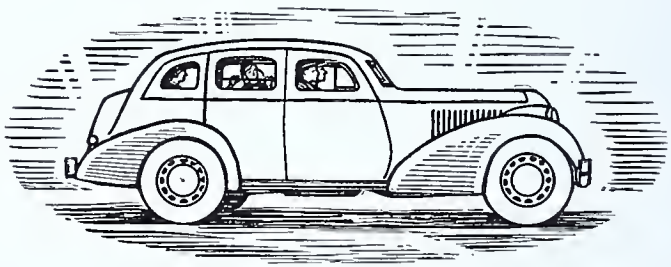
In spite of all this discomfort and inconvenience, the popularity of the automobile swept on. What did it matter that it was at present undependable and expensive?—

it would soon be efficient and cheap! What if springs were weak and roads were rough?—one would soon be made stronger and the other would soon be made smooth and pleasant! Who could object to the frightful bang and clatter of automobile engines, if he had the faith to believe that before long they might be made to run more quietly than a Swiss watch? Could progress be stopped merely because horses were frightened and caused serious accidents, frightened by a machine that might soon displace them altogether?

A vision had appeared! Man's desire for free mobility made him oblivious to everything but the fact that even in what seems to us now its prehistoric state the motor car was the answer to his age-long prayer. With all its faults, it showed unmistakable signs of moving him better, faster and more at his will than the horse and buggy or the railroad.

THE MODERN AUTOMOBILE

From this picture of its ancestors, it is easy to see that the modern automobile has come a long way forward to perfection. It is virtually everything that early cars were



not. It is beautiful, easy to operate, comfortable to ride in, efficient, smooth-running and quiet. If it is used with care and skill, the modern car is dependable, long-lived and safe.

For the most part it is run over smooth, hard-surfaced roads, and breakdowns are so scarce that many a motorist has had no more reason to look under his hood than one of mere curiosity. Service stations, garages, wayside inns, restaurants, tourist cabins and automobile camps have sprung up in abundance along our 900,000 miles of smooth highways, highways that we have built because of the fact that the motor car has given us mobility; we can at last move almost at will. A trip from Coast to Coast is no longer a rare event. In fact, travel agencies estimate that 37,000,000 persons spent their summer vacations in 1935 on automobile tours. Many of these trips were even longer than the distance across the continent.

For most of these people—no tire trouble, no bumpy roads, no "get out and get under." Instead, they enjoyed an inexpensive, pleasant trip. Is it any wonder that there are so many automobiles, that a motor car is the prized possession of almost every family, and that the depression has proved to the astonishment of many, particularly the mortgage companies, that many a family would rather sacrifice its home than its car.

In 1930, there were twenty automobiles for every one we had in 1913, or a total of 26,545,281 cars registered. Through the depression years, car registrations dropped slightly, but in 1934 there were still nearly 25,000,000 cars in actual operation, and early figures for 1935 indicate a large increase over that number.

ECONOMIC AND SOCIAL IMPORTANCE OF THE AUTOMOBILE

For years the automobile has been a dominant factor in our economic life. The automobile manufacturing industry employs directly about three million workers, and is indirectly responsible for the employment of half as many more. Raw materials from many lands are required in

building a car; to describe these items one by one would require a larger volume than this. Let us instead take a flying visit through an automobile assembly plant in order that we may appreciate the complexity of the cars that we ride in every day.

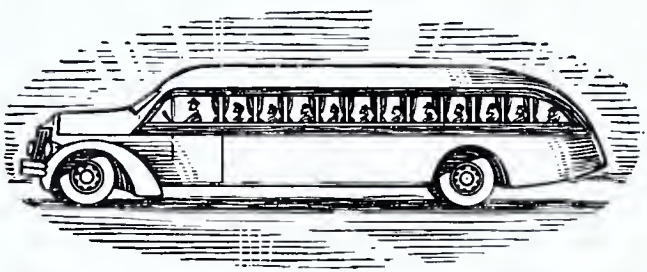
BUILDING AN AUTOMOBILE—By contrast to a busy automobile plant a five ring circus is simplicity itself. Thousands of men are at work, and scores of different operations are under way all at once. Loaded freight trains are arriving; men are moving their cargoes to every part of the plant. Over in one corner you see what looks like a blaze of fireworks, it is merely a worker welding the top of a car. In another employees are building cushions, placing them when they are finished on a moving conveyor which carries them nearly a quarter of a mile away where they will be ready when the body of the car is assembled.

On a similar conveyor, running along what is called "the assembly line," the entire car is put together piece by piece. Men are stationed at regular intervals along this line, each one responsible for attaching some vital part to the moving car. All is carefully planned, for the evolving car must arrive at each station just when the worker responsible for attaching a wheel or a hub cap has finished with the car next ahead. At one point an overhead hoist lifts an engine and swings it down in precisely the place where it belongs. Farther on another hoist that looks like a huge pair of ice tongs, places a completed body on the chassis. And so on, each man to his separate duty, until finally, at the end of the line, a worker steps into the car, starts the motor and drives off. An outsider wonders why a green car isn't turned out with brown fenders, or why at least once in a while someone doesn't forget to attach a gas tank. But none of these accidents

happens; each detail is too carefully planned, too closely watched.

The far-flung scope of the automobile industry, its insistence on careful planning, is emphasized by the fact that one large company estimates that it must use four freight-car loads of paper whenever it makes even a minor change; detailed instructions and drawings must be sent to all factories and assembly plants; dealers and garages must be notified. An important change may cost in this way alone as much as a million dollars.

SOCIAL EFFECTS OF THE AUTOMOBILE—Automobiles are such a common part of our social life that we often disregard the great variety of services they perform. We know that they are used for everyday business and errands, for short pleasure trips and long vacation tours. We know that they carry doctors, lawyers, business men and workers to and from their jobs, that they move farm produce and general merchandise, from butter and eggs



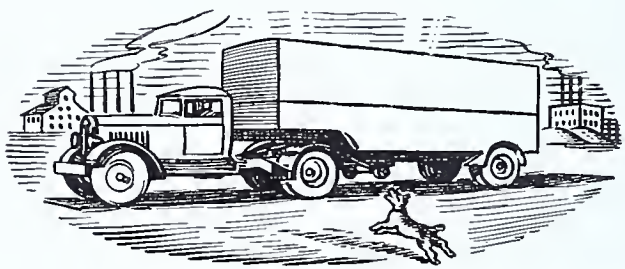
to steel and lumber. We know that under their influence towns have spread out and sprung up,—that a man can work in one city, live in another and have his close friends in a third. More and more people quit city life, and choose life in the suburbs and the country. Workers and their families move from place to place and we all enjoy a new freedom. What few sectional differences may remain in our country are constantly being removed as

the tourist from California or Louisiana fraternizes with the man Down East. We are a nation on wheels.

THE AUTOMOBILE AND THE CRIMINAL—With all the pleasure and advantages that we get from the automobile, comes also the possibility of serious misuse and abuse. The automobile, for example, has given criminals a new tool for their lawless work, one which authorities on crime say is of more advantage to them than the machine gun. Today the motor car takes the thug quickly from the scene of his crime, making him far more difficult to catch. In order to cope with this evil it has been necessary to establish throughout the country an elaborate and costly network of police radio and teletype.

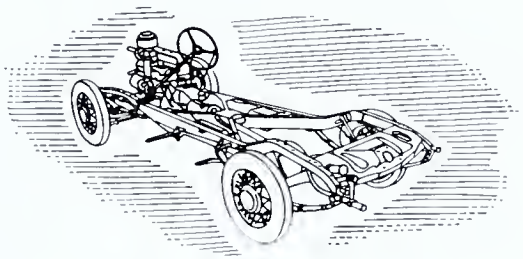
ACCIDENTS—Even more important is the misuse of the motor car by incompetent or criminally careless drivers. Such drivers kill more than twice as many persons annually as do criminals. The destruction of life, limb and property caused by our automobiles every year is appalling. In 1934, 36,000 persons lost their lives, nearly a million more suffered serious injuries in a total of more than 800,000 accidents.

A fuller statement of the accident problem and how to deal with it will form the subject matter of several of the later chapters of this book. Meanwhile we shall proceed with a study of the automobile.



CHAPTER II

WHAT MAKES IT GO



EVERY automobile on the road today is essentially a "fire-engine." This distinction does not belong exclusively to those crimson-colored vehicles that dash excitedly to conflagrations. They are concerned with *putting out* fires, but a "fire-engine" can be an engine that *goes by means of fire* as well as one that *puts fire out,* and that is just what an automobile engine is: the hot fire burning in its vitals is what makes it go. This burning is so rapid that it is commonly described as an explosion, but in reality an explosion is only a very rapid burning.

But let's start at the beginning. A motor car consists of engine, frame, body and wheels, compactly held together in one unit and made to move through a harnessing of the energies of heat. The rectangular steel frame is mounted on four wheels which are separated in sets of two. Between the wheels and the frame are sturdy springs designed to minimize the effects of jarring and jolting as the car travels over uneven surfaces. In its turn the frame supports engine and body, and in most automobiles the engine is placed in front of the body. This is the type of car that will be here described. In passenger cars the body is a seating compartment

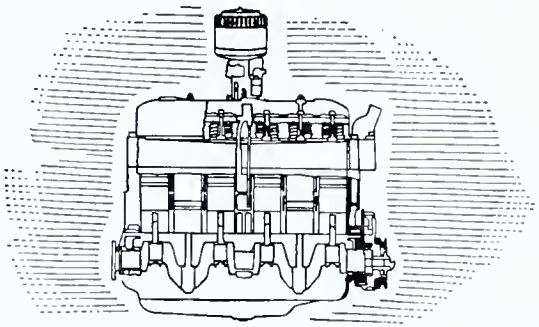
equipped with seats, doors and windows, and is usually built as a separate unit, often in another factory or by a manufacturer who specializes in such equipment. In trucks and commercial vehicles the main part of the body is designed for the carrying of freight.

The engine is the heart of the automobile; it furnishes the power for the turning of a crankshaft, and this power is passed on through a set of gears to a drive shaft and then through another set of gears to the rear wheels which, in turn, make the car go. The speed of the car is controlled by an accelerator pedal on the floorboard of the seating compartment which regulates the flow of gasoline and air into the engine. Reduction in speed and stopping is managed by a set of brakes, attached in most modern cars to all four wheels. An electrical system which not only provides lights but performs the auxiliary function of starting the engine and the regular one of keeping it running, and a cooling and lubricating system complete the complex mechanism of a motor car.

THE ENGINE

The heart of the engine consists of the four to sixteen cylinders in which the gasoline-air mixture is burned. Cylinders are tubes, closed at one end, in which "pistons" move up and down, when actuated by the explosions that go on in the closed end of the cylinders. The cylinders are in the neighborhood of three or four inches in diameter and ten or twelve inches long; the pistons are made tight-fitting through the use of "piston rings." The up and down motion of the pistons is converted through "connecting rods" into a rotary motion of the crankshaft.

HOW GASOLINE REACHES THE CYLINDERS—Gasoline is drawn by suction from a tank at the rear of the car into the engine compartment where it passes through a device called a carburetor. In the carburetor it meets air and



forms a vapor consisting of a mixture of gasoline and air. This is then drawn into the cylinders and burned.

At the closed end of each cylinder, which is at the top, are two valves, one of which permits the introduction of the gasoline-air mixture and the other allows what remains of the burned gases to leave. A valve is not unlike a stopper used to close the drain of a bathtub; when it is open gases may flow in or out of the cylinder chamber; when it is closed the gases cannot enter or escape.

THE FOUR-STROKE CYCLE—In an automobile engine the pistons operate on what is called a four-stroke cycle: an intake stroke down, a compression stroke up, a power stroke down and an exhaust stroke up. That is, each piston must move twice up and twice down to accomplish one complete burning of a gasoline-air charge.

THE INTAKE STROKE—In making the intake stroke, the piston moves down, creating a partial vacuum within the cylinder. With this downward stroke the intake valve opens automatically, the exhaust valve closing at approximately the same time, and the partial vacuum sucks in the gasoline-air charge.

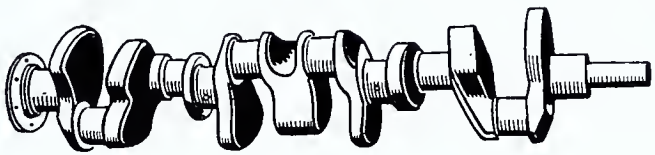
THE COMPRESSION STROKE—When the piston has moved to the lower end of the cylinder and the charge has en-

tered, the intake valve closes, the exhaust valve being closed also, and the piston moves upward, squeezing the gases into a small space at the top of the cylinder. The squeezing is necessary or desirable because, the greater the pressure developed by the gases, the more power they will exert when they burn, and the more power the engine will therefore create. The first upward movement of the piston is the compression stroke.

THE POWER STROKE—At approximately the upper end of this stroke the gases are ignited by an electric flash from a spark plug. The spark plug is screwed into the upper part of the cylinder. It has at the end on the inside of the cylinder two metal points that are separated from each other by about the thickness of a dime. When an electrical charge is sent through the spark plug, it jumps the space between these points, causing a spark and the consequent ignition of the gasoline-air charge. After being fired, the gases burn with enormous rapidity. About four one-thousandths of a second is taken to complete the burning. The temperature of the flame is as much as four thousand degrees, a heat which causes the gas mixture in the cylinder, now largely converted into carbonic acid gas and water vapor, to expand with great force. This forces the piston down again, this time in what is known as the power stroke.

THE EXHAUST STROKE—As the piston completes the power stroke, the exhaust valve opens. On its next upward stroke, the piston drives out the burned gases into the "exhaust manifold" and then through the exhaust pipe and the muffler and out into the air. This is the exhaust stroke. At the end of the exhaust stroke the exhaust valve closes again, and the entire process of intake stroke, compression stroke, power stroke and exhaust stroke is repeated.

WHAT THE PISTON DOES—How does the power stroke make the wheels turn? Each piston is attached by a connecting rod to a crankshaft (see figure below).



As the piston moves down on the power stroke its motion is converted through the connecting rod into a rotation of the crankshaft which then communicates its power to a large flywheel. The flywheel, in turn, transmits the power on through the clutch and gears to the rear axle and rear wheels. The flywheel is a stabilizer; it absorbs energy on the power stroke but gives up energy in forcing the pistons through the other three strokes.

REGULATING THE SPEED OF THE ENGINE—The power developed on the power stroke in each cylinder can be increased by burning more of the gasoline-air mixture, and a more powerful power stroke drives the engine faster. The speed of a car can therefore be regulated by controlling the amount of gasoline reaching the cylinders. This is accomplished by means of a valve between the carburetor and the cylinders, which is operated from an accelerator pedal on the floorboard in the seating compartment or from a hand throttle on the instrument board or steering post.

When the engine is running at low speed this valve is almost closed, checking the flow of gasoline-air charges. In consequence, when the piston completes an intake stroke only a small amount of gas has been sucked into the cylinder. On the other hand when the accelerator pedal is pressed down to the limit, the valve opens wide and permits a full size charge to enter the cylinder. The

engine then moves at top speed. When the engine is going at high speed there is therefore a higher compression in the cylinders.

The hand throttle accomplishes the same general purpose as the foot throttle or accelerator pedal, but there is one important difference. When foot pressure is released a spring automatically returns the accelerator pedal to its original position and closes the valve. The hand throttle must be opened and closed by hand; it has no springs.

STARTING THE ENGINE—To start the engine a gasoline-air charge must be ignited in one of the cylinders in order to force the piston in that cylinder through its power stroke. When this happens, that piston causes the crankshaft to rotate, sending another piston through its compression stroke and into its power stroke. As soon as each piston, one after another, produces its power stroke, the engine begins to run under its own power.

In order for this process to take place, the electrical system must be ready to furnish sparks through the spark plugs. It is prepared to do this when the driver turns a key-switch on the instrument board or steering post, and is then ready to produce the flash when the piston completes its compression stroke.

It is evident that power must, by some means, be furnished to the engine to make the strokes that are necessary before the charges in the cylinder can be fired. This power, in the early automobiles, used to be furnished by cranking manually, and hand cranking is possible in every engine today if the mechanical starting system fails. The power for starting in the modern car is, however, furnished by the "self-starter." This is an electric motor which, when operating, is geared to the flywheel. When the starter is put into operation it spins the flywheel; this causes the crankshaft to rotate and forces the pistons up and down until at least one of them completes a power

stroke. As soon as this happens the starter motor is disengaged. The starter motor is controlled by a button on the instrument board, by a pedal on the floorboard, or in some of the late models of cars, automatically by the accelerator pedal. Each button or pedal is in effect an electric switch connecting the motor with the battery.

THE CLUTCH

The clutch is one of the most interesting and important mechanisms in the modern motor car. Without it you would be unable to stop your car conveniently without turning off the engine, or to start smoothly from a complete stop. The clutch permits the crankshaft to rotate without turning the transmission gears or the drive shaft; it consists of two sets of discs; the surface of at least one of these is made of some highly frictional substance, usually cork, or an asbestos compound. When the engine is driving the car, these discs are held tightly together by springs, one set being driven by the crankshaft and the other passing the motion on to the transmission gears which, in turn, rotate the drive shaft. When the discs are pulled apart, there is no connection between the crankshaft and the rear wheels, and the engine runs without moving the car.

In most cars the clutch is controlled by the left one of two large foot pedals on the floor immediately in front of the driver. The driver pushes this pedal down when he wishes to stop the car without stopping the engine or when he needs to shift gears.

TECHNIQUE OF ENGAGING CLUTCH—When the engine is running in a car that is standing still, the clutch discs driven by the crankshaft are moving, but those connected with the transmission are not; they are separated by a small space, which is held free by pressure on the clutch pedal. If the clutch pedal is allowed to snap back quickly

and force both sets of discs suddenly to grip each other, the car jumps forward and the engine slows down with a jerk. As a result severe strains are placed on engine, clutch, transmission, drive shaft and rear axles, to say nothing of the discomfort caused to driver and passengers.

To avoid this damage and discomfort good drivers habitually permit the discs to engage smoothly by letting up on the clutch pedal slowly but surely, not in quick, rapid jerks. This has the effect of bringing the discs together gently, so as not to grip completely until they are running at almost identical speeds. Gradually they force each other to adopt the same rate of rotation, and when finally brought together, they cause no abrupt change in speed either in the engine or the wheels.

"RIDING THE CLUTCH"—Many drivers, even some who regard themselves as experts, have a bad habit of permitting their foot to rest on the clutch pedal while the car is moving at an even pace or when there is no need for shifting gears or stopping the car. This light pressure on the clutch is sufficient to pull the discs a small distance apart, just enough to allow the surfaces to slip past each other without gripping tightly as they should. As they slip, they rub and scrape each other, causing unnecessary wear of the discs and the bearings and finally a premature breakdown of the clutch mechanism.

THE TRANSMISSION

In an automobile the power produced by the pistons is communicated first to the crankshaft and then to the flywheel and clutch discs. Before it can be made to turn the rear wheels, however, it must be further transmitted through a set of gears known as transmission gears.

WHAT GEARS DO—A gear is a wheel having notches and teeth on its edge. It is used to turn another wheel simi-

larly fitted with notches and teeth, the teeth of one gear meshing into the notches of another so that as one gear wheel turns the other turns also. If there are the same number of teeth on both gears the two, if meshed, will complete one revolution simultaneously. However, if one gear has twice as many teeth as the other, the smaller gear must revolve twice in order to turn the larger one once. Similarly, if one gear has sixty teeth and another only twenty, the twenty-tooth gear will turn around three times while the sixty-tooth gear turns once. To the same degree to which a gear loses turning speed, it gains turning force; a gear wheel with sixty teeth driven by a gear wheel with twenty teeth will have three times the turning force.

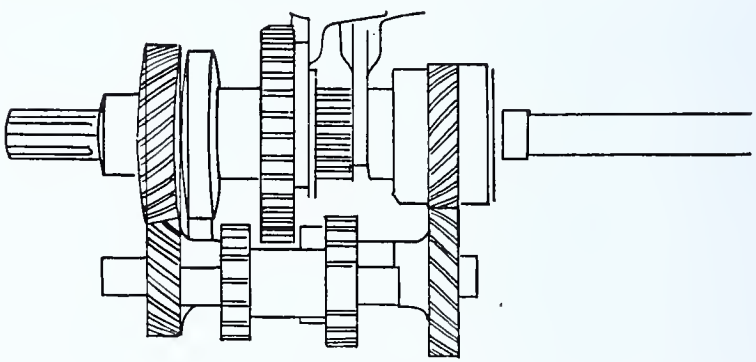
THE GEAR SHIFT—At the right of the driver's seat is a long lever called the gear shift. It is used to change the transmission gearing arrangements, that is, to throw in and out gear wheels with various numbers of teeth, so that the engine may exert various degrees of turning force on the drive shaft. In passenger cars the gear shift commonly has five positions which may be imagined as forming a letter "H." The cross bar of the "H" is the "neutral" position; the top of the left upright is the "reverse," the bottom position at the left is "low" or "first." The right upper position is "second," and the right lower position "high."

When the gear shift lever is in neutral, the gears do not mesh, and even though the clutch is engaged the engine will not move the car. The three positions: low, second and high are called "speeds," all of which make the car move forward. In some passenger cars there are four forward speeds, and on trucks as many as eight. In low gear the crankshaft usually must turn about three times to produce one revolution of the drive shaft. In second, the crankshaft rotates about one and one-half

times for each revolution of the drive shaft; while in high, the crankshaft is directly connected to the drive shaft and, therefore, produces revolution for revolution. There is a further reduction of speed between the drive shaft and the rear axle shafts so that the drive shaft turns four or five times for each revolution of the wheels. In low gear, for a given engine speed, a car will move only one-third as fast as in high, but, as explained above, with three times as much force. In second, the speed is lower than in high, but the turning force is fifty per cent greater.

To overcome the force of inertia more force is required to start a car and to pick up speed than to maintain a steady pace. Therefore, low gear is used first, and as the car gathers speed, second gear is employed. Finally, a shift into high gear is made to maintain cruising speeds. Before each shift the clutch is disengaged to allow the gears to run freely until the shift is completed.

THE GEAR BOX—What is inside the gear box is shown in figure below. The rotary motion of the crank shaft is transferred to a short counter shaft parallel to the drive



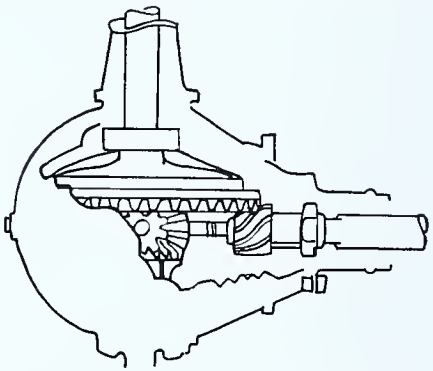
shaft, by means of two meshing gear wheels, one on the drive shaft and one on the counter shaft. The motion of the counter shaft is then transformed back into a motion of the drive shaft by a similar arrangement of gears. If

the two sets of gears were exactly similar, no change would have been effected. As a matter of fact, however, the ratio of the number of teeth on the two gear wheels in the first set is different from that in the second set so that the drive will move at a speed that is different from that of the crank shaft. This is not only the case in general but there are various combinations of gears that can be shifted into operation by means of the gear shift, thus producing the various speeds of which the car is capable, and the shifting of gears by means of the gear shift is nothing else than the shifting into operation of these various combinations of gears that will serve to move the counter shaft at various speeds.

THE UNIVERSAL JOINT—The engine and transmission gears are mounted on the frame and are connected with the rear axle by a drive shaft. The rear axle, however, is separated from the frame by springs, and as the car goes over uneven surfaces the distance between the rear axle and the frame changes. This, in turn, changes the angle between the rear axle and the engine. If the drive shaft were rigid, it would therefore bend or break when the car hit hard bumps. To prevent such changes in the angle from affecting the operation of the car, the drive shaft is provided with one or two universal joints, permitting it to rotate and move up and down at the same time.

THE DIFFERENTIAL—Before automobiles could be built on a practical basis, engineers had to solve the problem of how to drive the two rear wheels as the car rounded a turn. Whenever two objects go around a curve abreast, the one on the outside must travel a greater distance and, in order to keep abreast, must therefore travel faster. If the two rear wheels were rigidly attached to the same axle, it would be impossible for them to turn at different

speeds. One wheel would have to slide as well as turn. This, in fact, is what happens in the case of railroad cars where the wheels are rigidly fixed to the axles, and this largely accounts for the wearing out of the rails on curves. The solution of the automobile problem was found in a complicated mechanism called the differential gear. (See



drawing shown above.) Each of the two rear wheels is mounted on its own axle and these are connected to the drive shaft by a gear and pinion device located with the differential gearing in that bulge you see in the center of the rear axle housing. The differential gear causes power to flow to the wheel which offers the least resistance in turning (on a curve, the outside wheel), and permits the two axles to move at different speeds. The mechanism by which this is accomplished is too complicated to explain here.

LUBRICATION

Viewed through a high-powered microscope, even the smoothest metal surfaces are seen to be rough. For example, the smooth-looking and shiny surfaces of a piston are really a series of miniature mountain ranges and valleys, sharp edges and hooks. The same is true of the hundreds of other metal parts which must slide over each

other smoothly if the engine and car are to run at all. In many cases their clearance range is less than one-thousandth of an inch. If these surfaces were not held apart they would grind against each other, causing considerable damage in a short time. In consequence, lubrication is an important and essential feature of automobile operation.

A lubricant is a substance that holds two surfaces apart so that they may glide over one another more easily. If you press the tip of one of the fingers of your hand firmly against your thumb, you will find, if you try to move it, that it slides with difficulty. Moisten your thumb, and try the experiment again. This time the film of moisture acts as a lubricant and enables the skin surfaces to slide over one another more easily.

In automobiles, the principal lubricant is oil, although grease, graphite and other compounds are used in particular places. Except where friction is desired, practically every part of an automobile that moves or slides past another part is treated with oil or grease. Because its moving parts travel at particularly high speeds and because of the high temperatures developed, the engine has the greatest need of effective lubrication.

Two principal systems are in use to lubricate automobile engines, and usually a combination of the two is employed. The first is the splash system. This requires a quantity of oil to be placed in the lower part of the crankcase; then as the crankshaft revolves rapidly it dips the ends of the connecting rods into the oil and they splash it on many of the internal working parts of the engine.

The second is the pressure system. This requires the drilling of small passages through the crankshaft and connecting rods leading to bearings; oil is then sent through these passageways throughout the engine system by

means of a mechanical pump driven by the crankshaft. The cylinder walls and pistons receive their lubrication by means of a supplementary splash system.

Transmission gears, springs, steering gear and axles need lubrication also, if they are to function satisfactorily and enjoy a long life. All lubrication requires periodic attention by the owner of the car.

THE COOLING SYSTEM

We spoke of the enormous heat generated by the burning of the gasoline-air charges in the cylinders, and we know that heat causes objects to expand. Unless the engine were cooled, this heat would become so intense that the pistons would stick in the cylinders, checking the movement of the car, or the cylinders might burst or twist out of shape.

With one exception, all modern cars have a water cooling system. Water is circulated through a water jacket which surrounds the cylinders by means of a pump driven by the crankshaft. As water is pumped from the radiator through the water jacket, it becomes heated because of the high temperature of the cylinders which, in turn, are cooled by giving up their heat to the water. The hot water then passes, under the action of the pump, to the top of the radiator. The radiator consists of a number of fine metal tubes or their equivalent that are exposed to the air. The water in the tubes loses its heat to the cool air that passes over them. Fresh, cool air is constantly drawn through the radiator by means of a fan operated by the crankshaft. As the water cools it passes to the lower part of the radiator and again is pumped back through the water jacket around the engine. The function of the cooling system is to take away the heat of the engine and give it to the air flowing past the car.

WHEN THE COOLING SYSTEM FAILS—Several things may go wrong with the cooling system. The radiator may spring a leak; the water may freeze and hinder circulation; grit may block the passages in the radiator; the pump may break down; or the fan belt may snap. If any of these occur, the water soon becomes so hot that its efficiency in carrying heat away from the engine is destroyed and in fact it may boil away entirely.

THE STEERING GEAR

When the driver turns his steering wheel, this motion is communicated to the shaft on which it is mounted. At the base of this shaft is a spirally-grooved cylinder which rotates as the shaft turns and causes an engaging piece of metal to move. Through a series of connecting joints, rods and levers this motion is communicated to the steering arms which are attached to the front wheels. As the arms are pushed or are pulled the wheels move either to the right or the left. The gearing is arranged so that a one-pound tug on the steering wheel may become a thirty-pound pull on the steering arm, making it unnecessary for the driver to exert great strength in steering his car. The effectiveness of the mechanism depends upon its being kept in good condition.

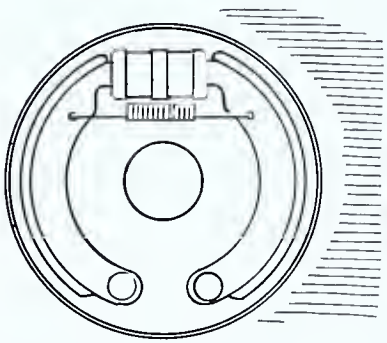
THE BRAKES

Brakes are stopping devices, and because they must often halt the car more quickly than the rate at which it started, they must be more powerful than the engine itself. Today most cars have brakes on all four wheels. If you look at the inner side of the wheels of a car, you will see a pie-shaped cylinder firmly attached to each wheel. This is called the brake drum, and inside it are the essential mechanisms of the brake apparatus,—the brake shoes and the brake linings. These are anchored so that they can-

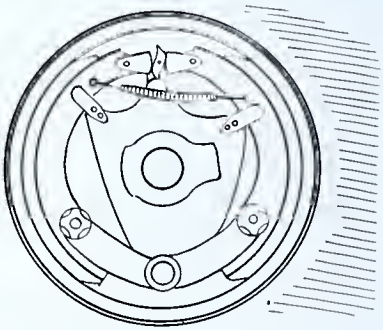
not turn. The linings are usually made of an asbestos composition in order to provide a high degree of friction and durability and are riveted to the outside of the shoes. The shoes are metal arcs smaller than the brake drums but equipped with a mechanism which forces them apart and against the drum when the brake pedal is applied.

Ordinarily the brake shoes are not in contact with the brake drum and therefore do not hinder the drum as it revolves with the wheel. When the brake apparatus is applied, however, the shoes are forced apart and bring the highly frictional lining surface against the inside of the drum. The high friction of the linings retards or finally stops the brake drums and, then, the wheels.

BRAKING SYSTEMS—There are two principal systems of brake apparatus,—the mechanical and the hydraulic. The mechanical system is so designed that, when the driver presses down on the brake pedal, it pushes or pulls



HYDRAULIC BRAKE



MECHANICAL BRAKE

on cables or rods attached to the brake shoe apparatus. The push or pull forces the shoes to press the brake linings against the drum. As the brake pedal inside the car is pushed farther and farther down toward the floor, the pressure of the linings on the drums increases.

In the hydraulic system, the brake pedal operates a

piston in a small cylinder filled with a special liquid. The cylinder is connected by strong tubes to other cylinders at all four brake shoes, and when the driver operates the brake pedal, the pressure on the liquid in the first cylinder is communicated through the tubes to the brake shoe cylinders. The latter are also equipped with pistons which operate to force apart the brake shoes, and when they receive liquid pressure from the central cylinder, their pistons move, causing the brake apparatus to do its work. As in the mechanical brakes, the greater the pedal pressure, the greater the pressure on the brake drum.

Power brakes are brakes which are aided mechanically so as to supplement the pressure exerted by the driver on the brake pedal, and consequently, to increase the braking force on the drums. The power is usually supplied by the vacuum within the intake manifold or through the operation of the crankshaft. In air brakes, compressed air is utilized to operate the brake shoes.

THE PARKING BRAKE—In order to prevent a car from rolling when it is left standing, it is provided with a hand-operated auxiliary brake known as the "parking" or "emergency" brake. In cars equipped with a mechanical braking system, no separate unit is needed, for the hand brake may merely supply a second method of setting the system in operation. The difference is that the parking brake not only applies the brakes, but holds them in place until they are released, whereas the foot brake springs back as soon as foot pressure is taken away.

In some other cars, the parking brake is a separate unit attached to the drive shaft, and when applied, prevents the shaft from turning. If the shaft cannot turn, the rear wheels cannot turn. Parking brakes are not as effective as foot brakes and are rarely used in stopping a moving car, and then only to help in an emergency;

they merely keep it stationary after the driver has brought it to a stop.

BRAKES AND FRICTION—The function of brakes is to develop enough friction to slow down the wheels. Friction causes heat, and when brakes are applied frequently, steadily or suddenly with great force, temperatures as high as 1400 degrees—enough to forge metals—may develop. Undue or unnecessarily prolonged applications of the brakes, or frequent stops from high speeds, may damage brake linings prematurely or impair the brake drums. In ordinary operation brakes are sufficiently cooled by the air flowing over them.

THE ELECTRICAL SYSTEM

We have already seen that electricity is used in firing the gasoline vapor charge within the cylinders. It is used also to provide current for headlights, parking lights, tail lights, stop lights, and lights within the passenger compartment. It is used also to operate the starter motor, in some cases to run windshield wipers, cigar lighters or radios. Where does the current come from? It is supplied from two sources, a generator and a storage battery. The battery is kept charged by the generator. After the car is started, the current in general is supplied directly by the generator, although the storage battery even then acts as an equalizer, but if the generator voltage falls below a certain point, the storage battery is switched in automatically. The generator is so constructed that the current from the generator to the battery is reduced at higher engine speeds so that when a car is running at high speed the battery is not in general being charged. This tends to prevent overcharging. The generator can be adjusted to produce more or less current. It should be regulated to meet driving conditions and needs, which

will differ according, for instance, to the amount of night driving. This is a job for a competent mechanic.

THE IGNITION SYSTEM—An essential part of an automobile is the mechanism by which a spark is made to fire the charge in the cylinders in order to produce the power stroke. The current for this comes from the generator or the storage battery. The voltage of this current is quite low, not over six to eight volts. In order to produce an adequate spark, particularly against the compression that exists in the cylinders, the voltage must be greatly increased, it must be "stepped up" to between 5,000 and 10,000 volts. This is accomplished by a small electrical device called the "coil," which performs much the same function as a "transformer."

In the case of an "alternating current" (AC) such as is commonly used now in city and suburban lighting installations, when a current of one voltage flows through a transformer on one circuit, a current of another higher or lower voltage can be made to flow out of the transformer on another circuit.

When, however, the current is "direct" (DC), as is necessary in the automobile, since a storage battery, giving direct current, is one source of current, the "induced" or transformed current will not be continuously produced but only when there is a "make" or a "break" in the circuit.

THE DISTRIBUTOR—The breaking of the circuit that carries the low voltage current from the generator or the storage battery is effected by a "distributor." The distributor performs two major functions. It supplies the necessary make and break in the primary or low voltage circuit through a pair of contacts or "points" which are opened and closed by a mechanism that is geared to the engine. It "distributes" the high voltage current, sending

the current at each make and break of the circuit to the spark plug in that particular cylinder where the gasoline-air charge is just ready to be fired for the power stroke.

The distributor is a delicate mechanism which may occasionally get out of order, and in that case the car may be put completely out of commission. As the fault can often be easily corrected, the owner of a car ought to receive instructions from a skilled mechanic on what to do under such circumstances. Sometimes an engine may be stopped from such a simple cause as short circuiting through the presence of dust and moisture on the distributor cover.

THE FUSES—An automobile contains either fuses or circuit breakers which perform the function of breaking the circuit should a short circuit occur or some other accident happen which has produced a dangerous increase in the strength of the current. When the circuit has been broken, the whole electric system may be out of commission until the fuse has been replaced or the circuit breaker reset, and steps taken to avoid the repetition of the circumstances. Spare fuses should be carried in the equipment, and the owner of the car should learn how to replace a burned-out fuse or to reset the circuit breaker.

ELECTRIC SHOCK—The high voltage of the secondary circuit, even though the amount of current used is very small, is enough to produce a very disagreeable shock if one comes in contact with it. This shock is not likely to be so dangerous in itself as because of the fact that it may cause one, in his reaction to it, to get into contact with moving parts such as the fan. The place where one is most likely to get such a shock is at the binding posts where the current is brought to the spark plugs.

LIGHTS—All automobiles are required to have headlights, parking lights and tail lights, differing in range, power and

intensity according to widely varying state and local codes and specifications. At the present writing, the headlight situation is chaotic; engineers are attempting to agree on a program that will not only produce better lighting but greater uniformity.

In general a headlight is a device to illuminate the road ahead and to warn other motorists and pedestrians of the approaching car. It is equipped with bulb, reflector and lens. The reflector is a curved, silver-coated surface designed to throw most of the bulb's light directly ahead of the car. The glass plate covering the light is really a lens, and its markings are designed not to be decorative but to distribute the light properly over the road.

Most headlight bulbs are equipped with two filaments arranged so that one throws a lower beam than the other or a beam that is directed to the side. The use of the different filaments is controlled by switches on the instrument board, the steering wheel or on the floor of the car.

RIDING COMFORT

Speed and riding comfort have been among the main objectives of automobile manufacturers ever since the motor car began to be developed on a commercial basis. In the early days when thirty miles an hour was top speed, a car that struck a bump jolted its passengers severely. The faster the speed, the harder the jolt. If present-day automobiles were built no better than early ones a speed of forty miles an hour would be impossible, not because of engine failure, but because passengers could not endure the shaking.

In the modern automobile, tires, springs, shock absorbers, and spring-cushioned seats all help to promote the smooth riding comfort of passengers. Tires are air cushions which, because of their pliability, absorb the minor shocks of the road. Springs between the axles and

the frame are built either in metal spirals or arches which change their shape under pressure, and when an automobile strikes a bump, they bend and absorb most of the shock. Shock absorbers supplement the springs. A bump must now meet the deflationary action of tires, springs and shock absorbers, and by the time its effect reaches the passenger compartment it has been translated into a gentle rocking motion.

CHAPTER III

HOW TO DRIVE

In spite of its complex mechanism and its enormous power the automobile is easy to operate. After a few simple instructions, the average person can take the driver's seat and make a car move or stop without committing any great number of errors. But the mere ability to operate a car is by no means the key to good driving; what is essentially important is the skill to control operation under all the unusual and shifting conditions of modern traffic. Only after months or years of driving experience can this control be acquired and developed to its highest usefulness. In aviation a pilot is judged by the number of "flying hours" that he has to his credit, or the actual time he has spent in the air; so in motoring, the driver may be judged by his number of "driving hours" or the time he has spent on the road.

DRIVING THE CAR

Let us suppose that you are about to take your first actual lesson behind the steering wheel. First you seat yourself comfortably in the driver's seat, making sure you can see without obstruction through the windshield, and making certain that your feet reach the clutch, brake and accel-

erator pedals easily. Then, jiggle the gear shift lever to determine that the gears are in neutral position. Next, switch on the ignition, use the starter motor, and when the engine starts, press gently on the accelerator pedal, remembering not to "race" the engine while it is warming up. In some cars switching on the ignition automatically operates the starter motor, in others pressing the accelerator pedal performs a similar duty, but in a greater number still, all three operations must be performed independently. The use of the "choke," which produces a richer mixture, will make starting easier, particularly in cold weather. The choke should be used as sparingly as possible because of the danger of gasoline getting into the lubricating oil and thinning it.

When the engine is running smoothly, press down the clutch pedal, thus disengaging the clutch, and shift the gear lever into low or "first" position. After you have taken a last look around to assure yourself that the road ahead and behind is perfectly clear, release the parking or emergency brake and let up on the clutch pedal in a slow, steady motion. Simultaneously, as the clutch begins to grip and the car begins ever so slowly to move forward, feed a steadily increasing supply of gasoline to the engine by means of a gentle pressure on the accelerator pedal. When the car has gathered a fair, even speed, release the accelerator pedal, disengage the clutch and shift the gear lever into second. Engage the clutch, again feeding gasoline steadily as before, until the car has picked up more speed. A third time you disengage the clutch, you shift gears into high, and again permit the clutch to engage. Now your car is in full motion, and its speed is determined by pressure on the accelerator pedal.

How long do these manipulations take? On a level, straight road (where all beginners should try their wings) a car can be moved through the shifts first, second

and high comfortably in less than fifteen seconds or a few hundred feet. Starting uphill or downhill will vary the time and distance required, and beginners quite naturally, because they are unfamiliar and often clumsy in making the movements, may take considerably longer. The old axiom, practice makes perfect, has nowhere a more important application than in developing skill in these fundamental operations. If you will remember to make all motions slowly but surely, particularly in releasing the clutch pedal on starting and in pressing down on the accelerator, you will have developed one of the priceless habits of good driving. Note that it is always necessary in shifting gears to disengage the clutch by pressing your foot down on the clutch pedal.

If you are swift and jerky, your car will jump and buck, eventually causing serious damage to the mechanism of the clutch. If you neglect to let up on the accelerator as you shift from one speed to another, the engine will race and turn the crankshaft disc faster than the transmission discs. Then as you try to move the gear lever there will be a noisy grinding of gears which can also cause serious damage. Again if you allow too little gas to reach the engine, a reverse condition arises and the clutch is "dragged," for the transmission discs are moving faster than the crankshaft disc. In such cases the car often stalls.

Now that you are safely moving in high gear, how do you stop? First you release pressure on the accelerator and press down slowly but firmly on the brake pedal. Just before the car comes to a full stop disengage the clutch and return the gear lever to neutral position. If the car is to be left standing pull back the parking brake, turn off the ignition switch, and take the key out of the lock. Other details such as hand signals, parking technique, etc., will be discussed in succeeding chapters.

STALLING

The unintentional stopping of an automobile engine is called "stalling," and an engine in good condition and in good adjustment stalls only when a driver attempts to make it do more work than it is capable of doing under the existing conditions. Beginners have many difficulties of this kind, principally because they forget to disengage the clutch when they apply the brakes or because they engage the clutch too rapidly or jerkily. Similarly, if parking or foot brakes are on when you try to engage the clutch, the engine will usually stall. Allowing the clutch pedal to snap back quickly when the car is standing still or an attempt to start the car in high gear on level ground may also stall the engine.

On steep hills, the engine may not be able to reach the top in high gear, and may stall if a shift into first or second is not made at the right time. Forced use of high gear under such circumstances places too heavy a strain on the engine—a strain it is not powerful enough to bear. An engine should never be allowed to "labor." Shifting into the proper gear lightens the burden, and enables the engine to perform its task with greater ease and without stalling. A good driver takes care not to stall his engine, not merely because he wishes to avoid this nuisance, but because he knows that under certain conditions stalling may cause a critical traffic situation and possibly an accident.

STARTING ON HILLS

One difficulty which frequently baffles a beginner, especially in hilly or mountainous country, is the starting of a car on an upgrade. If he releases the brakes, the car starts rolling backward; if he attempts to start with the brakes fixed, the engine stalls.

There are two ways out of the difficulty, both of which

involve a delicate combination of engine and brake power. The first method is as follows: with the hand brake still set, the clutch is disengaged, gears shifted into low, gasoline fed to the engine, and the clutch is engaged slowly. As the clutch begins to grip, and when the engine force is sufficient to overcome gravity, the hand brake is released. This is the preferred technique.

The second method requires the use of the foot brake and hand throttle. Pressure on the foot brake prevents the car from rolling back, and as gasoline is fed by means of the hand throttle and the clutch is slowly engaged, the brake may be released. Experienced drivers dislike this method for various reasons but partly because they may forget to close the hand throttle once they are under way. They use it only when they have been forced to stop quickly on a hill, and must start promptly again before being able to apply the hand brake.

MOMENTUM

Moving objects travel in a straight line without change in speed unless disturbed by outside forces, while motionless objects remain at rest until an outside force puts them into motion. Force is required to increase the speed of any object, to decrease its speed, or to make it curve from a straight path. These facts should be understood and taken account of by all drivers.

It is the inertia of the car moving under its own momentum that accounts for the fact that less power is required to keep it moving at an even pace on a level road than to start or stop it, for under such conditions the engine must provide only enough energy to overcome friction and air resistance. A perfectly streamlined, frictionless automobile, if it could be built, would be able to maintain any rate of speed on a straight, level road without any aid from the engine at all.

To arrest motion energy must be absorbed and the faster an object is moving the harder it is to stop it in a given distance. In mathematical terms the work required to stop an object increases as the square of its speed. If one object is traveling at twice the speed of another having the same weight, four times (2 x 2) as much effort is required to bring it to a standstill. A car moving sixty miles an hour is nine times (3 x 3) as hard to stop as one moving at twenty.

EFFECT OF SPEED IN COLLISIONS—When an automobile smashes into a fixed object such as a tree or a brick wall, stopping takes place "immediately." Under such conditions an immense impact force is developed by the car, and it is best explained by comparing it in terms of falling distances. At twenty miles an hour a car collides with a fixed object with the same force it would have if it had been dropped thirteen and one-half feet. At forty miles an hour the impact is the same as if the car had been pushed off the top of a four-story building or from a height of about fifty-four feet, while at sixty miles an hour it crashes as hard as if it had been driven over a precipice one hundred and twenty feet high!

BRAKING DISTANCES—In routine driving, momentum shows itself in its effect upon braking distances. A car equipped with four-wheel brakes in good condition can be stopped from a speed of ten miles an hour in six feet *from the moment the brakes are applied,* while at fifty miles an hour nearly one hundred and forty feet are needed. A table of speeds and stopping distances appears on page 43.

Most drivers are frankly skeptical about these stopping distances because they believe (without having made actual tests) that they can stop their cars more quickly. Often you may hear the expression: "Aw, I can stop my

car from sixty miles an hour on a dime." The figures in the table are, however, the results of real tests made by competent engineers, and brake manufacturers, relying on the tests, build brakes to meet these specifications. Remember, too, that the distances given are for ideal conditions on dry, straight, level roads with hard sur-

faces. If brakes are in less than good condition, if the car is going downhill or over wet or slippery surfaces, the stopping distances are correspondingly greater. Above all the actual stopping distances do not take into consideration "reaction time" or the time it takes a human being to react and to place his foot on the brake. *Brakes do not take hold until the driver's foot applies them.*

USE OF THE BRAKES

Reducing the momentum of a moving car through the use of the brakes is as important a part of good driving as being able to make emergency stops. As he approaches a situation where a quick stop may be necessary, the good driver reduces his speed so as to decrease the necessary stopping distance. He does this by means of a light pressure on the foot brake, and in controlling his speed avoids placing himself in a position where he can stop only by a violent application of the brakes.

The poor driver imagines that sudden stops indicate

he has complete control over his vehicle; he overlooks the fact that each emergency stop strains the structure of the car. Passengers in a car that is being brought to a sudden stop are thrown forward, and every part of the car strains to continue its forward motion. Rattles, squeaks and more serious troubles will appear if the driver habitually makes abrupt rather than easy stops.

Quick stops have a damaging effect on the brakes themselves, for braking develops a destructive degree of heat. The greater the brake pressure, the faster heat is generated, and the more rapidly brake linings are burned away. Furthermore, quick stops damage brake adjustments and reduce the efficiency and uniformity of brake pressure on each wheel.

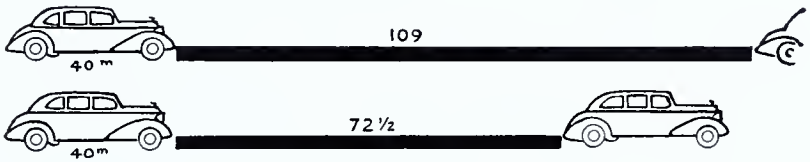
Thus, the easiest and least costly method of braking is gradually to decrease speed and momentum first by releasing the accelerator and second by applying the brake with a light, steady pressure. Then the car "floats" to an easy stop with a minimum of strain on brakes, car and passengers.

USING THE ENGINE AS A BRAKE

If a car is moving at fairly high speed and the driver takes his foot off the accelerator, there is immediately a perceptible slowing down, and eventually speed drops to five miles an hour or less. This is due not merely to friction and air resistance, but largely to the braking effect of the engine. As the engine slows down the crankshaft slows down likewise and the dragging effect is communicated to the rear wheels through the transmission gears and the drive shaft.

Actual tests have been made to measure this braking effect. It was found, for example, that a certain car was stopped from forty miles an hour in 109 feet when the driver disengaged the clutch at the moment he applied

the brake. However, when he permitted the clutch to remain engaged until he had nearly stopped the car with the foot brake, the braking distance amounted to only 72½ feet, a difference of 36½ feet. Good drivers take advantage of these facts, and wherever possible allow the engine to do as much of the braking as possible.



DESCENDING HILLS—The braking effect of the engine is especially valuable in holding the car back as it descends a hill. If little or no gasoline is fed to the engine, the car will maintain a pace low enough to assure complete control unless the hill is unusually steep. In second or low gear the braking effect is even greater. You will remember that in the discussion of gears in the preceding chapter it was explained that in second or low gear the drive shaft turns more slowly than the engine crank shaft. By the same token the crank shaft is forced to rotate faster than the drive shaft, and the more rapidly it turns, the more effective is its braking action. In second gear a car loses speed faster than in high, and in low the reduction is greater still. Experienced motorists, therefore, shift into second or low at the top of a steep downgrade.

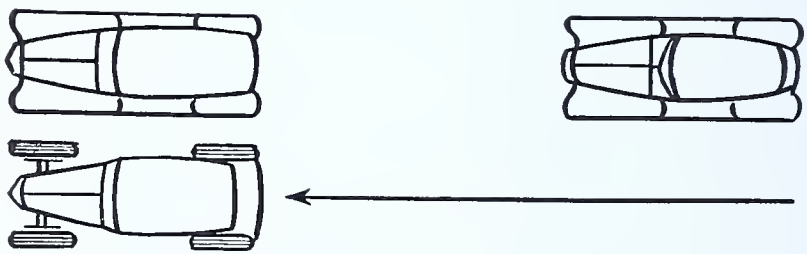
COASTING—Coasting is a bad practice which has so often had disastrous results that many states have prohibited it entirely. To coast, drivers disengage the clutch or even shift into neutral and permit their cars to roll downhill. Under such circumstances the braking effect of the engine is lost, and the only method of stopping or slowing down is through the use of brakes. Often, because of the tremendous absorption of energy needed to overcome the

force of gravity, brakes burn out under such conditions, and then, if the driver is coasting, his car will be completely out of control.

FREE WHEELING—Free wheeling involves the use of a device which brings the power of the engine into operation upon the car only when its effect will be to maintain the existing speed or to drive the car still faster. The effect produced is exactly the same as with a coaster brake on a bicycle. When free wheeling is in operation the car will coast and the engine cannot be used as an auxiliary brake. Cars equipped with this device have a disconnecting plunger or button on the instrument board. Free wheeling should always be disconnected or locked out on hills.

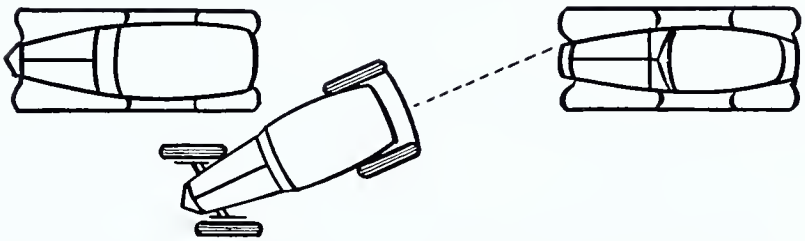
PARKING

Parking requires considerable skill in the manipulation of steering wheel, clutch and brakes, and to the new driver it always presents a difficult problem. Like other skills, it requires practice, and is best done in a deliberate and unhurried manner. Where few cars are parked, the manoeuver is simple, and the driver merely steers his car until it is parallel to and near the curb; the only special care that is needed is in judging the position of the right wheels as related to the curb.

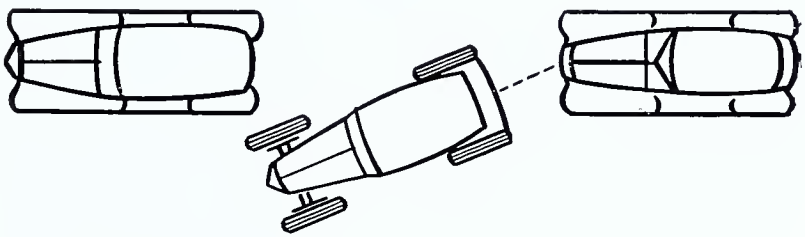


Difficulties arise, however, in places where there is enough space only for one or two more cars. One way of meeting such a parking problem is as follows: The driver

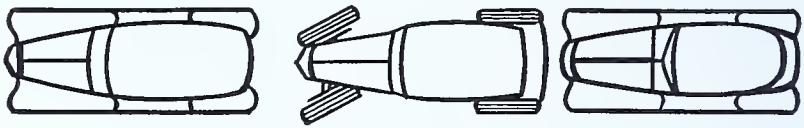
should stop his car alongside and a trifle ahead of the one in front of the available space. His car should be parallel to the other with about two feet of space intervening.



Then, after making sure there is no danger from oncoming traffic, he should slowly back his car into the space, turning sharply so as to steer back toward the curb. As the car moves into the space, its position may be gauged by keeping the center of the rear window in line with the radiator cap of the nearest parked automobile facing the space.



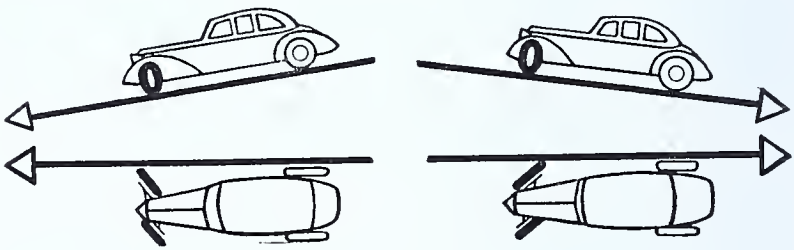
Attention should be given to the front end of the car as soon as it begins to edge into the space in order to avoid damaging the car ahead. As soon as it is safe to do so the steering wheel should be turned to bring the front wheels against the curb. When the car has been backed as far as it will go without hitting the car behind, it may be moved forward to complete the parking manoeuver. If the available space is small, it may be necessary to



move back and forth several times until the car is "inched" in toward the curb.

Sufficient space should be left in front and behind to allow other drivers a chance to move their cars out without striking your car or their own. Low speeds must be used, and the speed can be controlled by the slow engagement of the clutch.

PARKING ON HILLS—Because of the many dangers involved, parking on hills requires special care. Brakes may be released in some unaccountable way, permitting the car to slip and roll downhill entirely out of control: children, for instance, playing in a car have sometimes released the parking brake and started it off downhill, and in other instances a car has been accidentally bumped by other cars and started rolling.



In parking on the upgrade it is best to turn the front wheels outward, that is, away from the curb, so that the curb will act as an obstruction if the car starts to roll. On the downgrade the car should be pointed as though it were trying to climb the sidewalk. If there is no curb, or even in any case, the gear shift should be left in low if the car is pointed downhill, or in reverse if it is facing

uphill. The procedure of leaving it in reverse if the car is pointed downhill and in low if it is facing uphill might seem to be more effective, but this will not be substantially more effective and may be bad for the engine.

SKIDDING

Because it carries such a feeling of helplessness and the possibility of complete loss of control, skidding is an experience which good drivers dread. A skidding car moves sideways instead of forward or backward; its tires move greasily over the road surface, and the wheels do not obey the steering wheel.

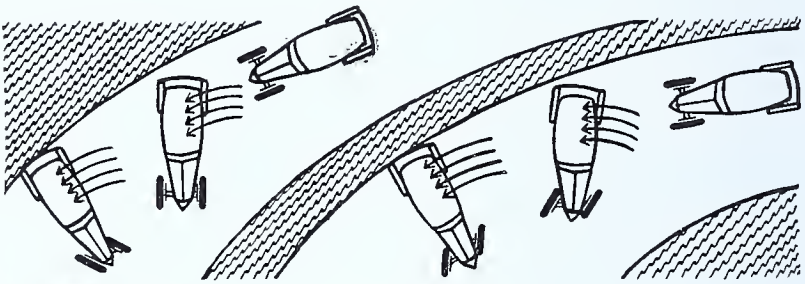
If you tie a stone on a string, swing it around your head in a circle and then suddenly let go of the string, the stone flies off in a straight line tangent to the circle. This is due to the action of centrifugal force. A car rounding a curve acts as though a strong hand were pushing it sideways. This is also because of centrifugal force. Under ordinary conditions and at lowered speeds the friction between tires and the road surface is sufficient to prevent the wheels from skidding sideways. If, however, the surface of the road is covered with water, snow or ice, the tire traction is reduced, and unless lowered speeds are used, the car will skid. Wet leaves on a hard surface or sand and gravel surfaces, because they give tires no firm grip, have the same effect.

The faster a car goes, the greater is its centrifugal force, increasing as the square of the velocity, and when that force becomes greater than friction, skidding occurs. An automobile can go so fast that even the normal high friction of new tires will be unable to overcome the side thrust on a sharp turn. Again, an attempt to stop a car on a curve when it has been traveling too fast may result in a skid. Instead of helping, the application of brakes

may make the situation worse. Therefore, a curve should never be entered at high speed.

Even on a straightaway brakes may cause a skid if the pavement is slippery. If one of the brakes is better than the others, the car tends to swing around that wheel. The effect is the same as when one drops anchor from a boat, the craft swings around the anchored end. A similar situation prevails if one tire grips the ground better than the others, or if brake adjustments on all four wheels are not equal.

RECOVERING FROM A SKID—The object to be accomplished in the case of a skid is to get the car moving



Wrong *Right*

forward so that it will obey the steering wheel instead of sliding. Therefore, in general, the accelerator should be used rather than the brake. Most skids are caused by the side-slipping of the back wheels. In such cases, the front wheels should be turned in the direction of the sideways motion. This is based on the assumption that traffic conditions and road conditions will make such a procedure possible and feasible.

Many drivers feel that when they are involved in a skid the thing to do is to jam on the brakes, and beginners express their amazement when they see an experienced driver step lightly on the accelerator instead of the brake pedal when his car begins to slide. Although the procedure may seem contrary to common sense, the basic

rule for recovering from a skid is to do exactly the opposite of what caused the skid if possible. For example, if applying the brakes started the skid, release them. It should be remembered also that the engine itself has a braking effect, so that taking your foot off the accelerator is equivalent to braking. This alone has sometimes produced a skid on a very slippery surface.

SKIDS SHOULD BE AVOIDED—The best way to deal with skids is not to have them, for, after all, the methods described above can be used successfully only at low speeds. A driver is helpless in a high speed skid or in traffic. A car traveling fifty miles an hour on a highway in California came to a sharp curve where the surface of the road was covered with little pebbles washed down from a hillside. As his rear wheels began to skid on the pebbles, the driver realized he was helpless, for at that speed if he turned in the direction of the skid he would plunge off the road. If he had used his brakes he would have flipped the car over like a pancake. The car skidded through a guard rail, and the driver was lucky to escape with a broken arm and hip.

In this case (and in every case) a skid could have been avoided by lowered speed. It is infinitely better to be in a position suddenly to increase speed rather than be forced violently to decrease it. Avoid sudden actions, especially sudden changes in direction and sudden applications of the brakes, even sudden release of the accelerator pedal, and you will avoid skids. In fact, for every reason, no driving motions should be made suddenly.

CHAPTER IV

THE DRIVER—HIS NATURE AND HIS HABITS

BEFORE getting to the real heart of the subject, the art of driving, we must know something more about the driver himself and about the highways over which he is to drive. This and the succeeding chapter will deal with the driver.

EYESIGHT

Nowhere is good eyesight more important, more necessary for self-preservation than behind the wheel of a motor car. Men with impaired vision may muddle through certain other activities such as walking, reading and swimming, but when they drive automobiles it is imperative that they see clearly, quickly and comprehensively. This is the more important when one recognizes the vast numbers of people who, according to specialists, actually do not know that their sight is defective, and that sight like other physical abilities tends to weaken with age or excessive strain.

Fortunately, optical science can correct most common visual defects. In states where eyesight tests are required as part of the ordinary licensing examination, this fact is appreciated and licenses are withheld until the applicant

with defective eyesight provides himself with glasses or furnishes the authorities with other evidence that his deficiencies have been removed.

COLOR BLINDNESS—Among the eyesight limitations most commonly unappreciated by drivers and would-be drivers are color blindness and "tunnel" or "barrel" vision. Color blindness usually takes the form of an inability to distinguish a red from a green, or, in some cases, a yellow from a blue. In rarer instances color blindness is a total inability to see any color at all. The defect cannot be corrected by glasses. It is obvious that the color-blind driver is certain to have difficulties as a result of his defect. Traffic lights and various other roadway warning signs and signals are likely to escape his perception entirely unless he acquires some means of his own of compensating for his lack of color sight. He must drive with a special kind of care, relying on clues other than color for his own safety and that of others. Anyone who questions his own capacity to see colors should have himself tested.

"TUNNEL" OR "BARREL" VISION—If you cannot perceive objects at an angle to your direct line of vision, or "out of the corner of your eye," you are a victim of "tunnel" or "barrel" vision. In driving, such a disability prevents a driver from seeing other cars or pedestrians as they approach him from the side or from cross streets until they are almost directly in front of him. His field of vision is restricted so that he sees objects as though viewing them through a tunnel. Sometimes the defect is present in only one eye, or is caused by thick lenses on glasses. A case where it is deliberately created and used to advantage is where horses are equipped with blinders to prevent them from shying or kicking at objects which come at them from the side.

You can check yourself for tunnel vision by fixing your gaze on some object directly in front of you, and asking a friend to come up noiselessly alongside of you from behind. At what point do you see him?

REACTION TIME

One of the outstanding characteristics of the good driver, directly traceable to his ability to see, is the speed of his "reaction time." This is the time actually consumed between the instant the driver's eye flashes his brain the signal STOP and the moment he applies his foot to the brake. On the average this time is three-quarters of a second. An example will illustrate the point more clearly. An average, clear-sighted motorist is driving thirty miles an hour along a level, dry road. Suddenly a child darts out from the sidewalk into his path. He applies his brakes "immediately," and brings his car to a dead stop within eighty-three feet, just missing the child. A good set of brakes on such a road would bring the car to a stop from a speed of thirty miles an hour in fifty feet. Why did it take this man eighty-three feet to complete the manoeuver? Right! The answer is "reaction time."

Here's why. At thirty miles an hour a car travels forty-four feet per second. If the man had an average reaction time of three-quarters of a second, then his car went thirty-three feet even before his foot applied the brake. Thirty-three plus fifty equals eighty-three,—a perfect average for both man and brakes.

Naturally, reaction times differ, some people being faster than others. Even the same person varies from time to time, depending on his mental or physical condition. A chart on page 43 illustrates the total stopping distances, including reaction times, at various speeds.

PANIC—One of the serious disturbers of reaction time is panic; this affects certain drivers when they find them-

selves in a tight spot. For a few seconds panic paralyzes their senses, making them utterly incapable of rendering a decision—carrying them on probably hundreds of feet. Such persons are usually found among inexperienced drivers, who, like all drivers with slow reaction times, should drive slowly and carefully, and as far as possible make decisions long before it becomes necessary to carry them out.

MISJUDGING SPEED AND DISTANCE—Accuracy in measuring speed and distance is a fundamental requirement of good driving, depending largely on clear vision and swift reaction time. Any inability in this respect must seriously lower the quality of driving and is apt to result in such errors as following another car too closely and driving faster than is justified by the assured clear distance ahead. Incorrect estimation of speed and distance is the major fault of at least twenty per cent of the drivers in the accident-prone group whose weaknesses are described later in this chapter.

A man had nine automobile accidents in a single year, all of them involving rear-end collisions. They occurred when, as he drove up to an intersection, he suddenly discovered that he was closer to the crossing than he anticipated. Whereupon, to avoid striking other cars crossing his path, he jammed on his brakes and whatever car happened to be following him inevitably bumped him. Was this man unlucky, or was he a bad judge of speed and distance?

STRENGTH—Strength is not especially important as a prerequisite to automobile driving. Except for braking under exceptional circumstances, or steering in an emergency no great physical exertion is required, and a comparatively frail person should be capable of routine driving. He should exercise great care, however, and not

drive beyond the limitations of his strength. Sometimes a tire must be changed, where help cannot be had. That requires both strength and skill.

HEIGHT—Persons of unusual height, tall or short, usually encounter difficulties in driving—especially with the clutch or brake pedals. A tall person is cramped and a short one strained. Both should be able to remedy these conditions by making adjustments in the driver's seat.

A tall person, according to actual tests, is more apt to have a slower reaction time than the average because of the length of his legs and the difficulty of moving them quickly in a cramped space. A short person, if close enough to the brake pedals, has a faster reaction time for a similar reason. Both can improve their skill by practice.

SPECIAL DISABILITIES—Many other physical limitations may handicap the motorist in his desire to be a safe driver. While it is true that men minus an arm or a leg have qualified as safe drivers in spite of their disabilities, they did so because they exercised the most extreme care. Those who are afflicted with deafness, chronic disease, habitual nervousness, emotional instability or high blood pressure and heart disease must realize they too are seriously handicapped for safe driving. They should either stay away from the wheel or be prepared always to drive with exceptional caution.

SUPERIMPOSED DISABILITIES

CARBON MONOXIDE—Carbon monoxide and alcohol are both poisons which superimpose serious disabilities on the sound and the unsound driver alike. Carbon monoxide is a poison gas generated by the incomplete burning of carbon compounds, and is present in deadly quantities in the exhaust gases discharged from automobiles. The lethal nature of carbon monoxide is not to be ignored,

especially when you understand that a two-hundredths per cent concentration in air breathed is dangerous, four-hundredths per cent may be fatal. *The concentration in the exhaust gas discharged from an automobile in average condition is about seven per cent.* The gas is colorless, tasteless and odorless and gives no warning of its presence.

If you breathe it, your lungs pass it on to the blood stream where its chemical action displaces vital oxygen cells. The first evidence to the victim is a slight drowsiness, then headache and finally unconsciousness, all in the space of an amazingly brief time. Anyone affected should be taken with all possible speed out into fresh air and given ordinary resuscitation treatment such as one renders drowning patients, while someone else calls a doctor. If allowed to remain in atmosphere contaminated by carbon monoxide, a victim of the poison must certainly die.

Everyone has heard instances of unfortunate people being overcome by the poison while working in a closed garage where a gasoline engine was allowed to run without proper ventilation. But all are not so familiar with the more recent tests showing that carbon monoxide is dangerously present in the seating areas of many moving motor vehicles. In such cases it discharges under the car as a result of split or otherwise damaged exhaust pipes, and because of engine inefficiency. It enters the car through broken floor boards and through leaks around the pedal controls and wiring devices. The gas may also come in through the windows when the driver follows another car too closely, especially a large truck or bus. Everyone should inspect his car regularly to guard against this lurking menace.

If the driver or any of his passengers suffers drowsiness or headache en route, immediate consideration should be given to the possibility of carbon monoxide.

The car should be stopped and the one who is afflicted should be allowed to fill his lungs with fresh air.

ACCIDENTS FROM CARBON MONOXIDE—Undoubtedly the presence of carbon monoxide in moving motor vehicles accounts for many otherwise unexplained accidents and perhaps for many of those now vaguely attributed to such causes as "drove off roadway," "did not see corner," "fell asleep" or many others. Under its insidious influence a driver becomes less alert, his reaction time slows up, and his driving abilities are likely to become sluggish and erratic. Long before he feels the warning drowsiness or headache his ability to use the controls competently may completely disintegrate. He drives in a drugged condition, and if he loses consciousness, it is only too obvious what must happen to him and to his automobile and to his passengers.

ALCOHOL—Driving when you've been drinking is a serious violation of the rules of common sense and decency, not to mention those of safety. It is not a question of how many drinks a driver can endure before he becomes incapable of operating his car; the fact is rather that the smallest quantity of liquor has a definite, traceable effect upon his mental and physical reactions. Half a glass will render the majority of persons who try to drive erratic and slow in applying the brakes, cause them to exhibit bad judgment in their attempt to avoid objects on the road, and to display glaring inaccuracies in estimating speeds and distances.

Dr. Heise, of Columbia Hospital, Milwaukee, tested two groups of drivers not long ago, one of which was given a certain amount of alcoholic drinks. The alcoholic group made 59.7 per cent more errors, its eye and muscular coordination was thirty-nine per cent worse, and its braking distance thirty-seven per cent greater.

Drink gives most persons a kind of false confidence which if manifested at the steering wheel, lures them into taking spectacular chances with their own and other people's lives, chances that would appall them when sober. The drunken driver is likely to forget all rules of safe driving, all traffic laws and regulations. Or if he remembers them, he applies them erratically, often at the wrong time and place. Typical of the kind of false confidence supplied by alcohol is the story of a man who was recently brought to jail on a charge of driving while under the influence of liquor. He announced that he wasn't drunk; he was feeling fine; in fact, he could "lick the whole world." Police noticed, however, that he had considerable difficulty even in striking a match.

But experienced policemen testify that the person who has had only a few drinks is doubly dangerous. Unlike the total drunk, he operates his car unspectacularly, and is usually convinced that he is sober. But his reaction time is slower, he cannot think quickly and clearly, his judgment of speed and distance is not reliable. He may even go to extremes of caution, becoming because of his slow, deliberate progress along the street or highway a real hazard to other drivers who cannot understand at long range the reasons for his unusual movements.

The jarring effect of "just a few drinks" was demonstrated recently in an incident in Louisiana. A car traveling fifty miles an hour was driven off a state highway into a tree and was totally demolished. One passenger was taken to the hospital with a fractured nose, ten broken ribs and numerous cuts about his face. The driver said, "I must have dozed off. I didn't know anything was wrong until I felt the car going off the road Then it was too late. Yes, I had a few drinks, but just a few. I had one drink of rye before dinner, and two after dinner."

There is nothing that the man who has been drinking can do to compensate for the lowering of his driving skill. That is why the legislatures, the police and the courts regard him as one of the most serious menaces in modern automobile traffic, and deal with him accordingly. "Alcohol and gasoline do not mix." If you drink, you shouldn't drive; if you are going to drive, you shouldn't drink.

OTHER TEMPORARY DISABILITIES—Driving skill may be temporarily weakened by the irritation of other conditions besides carbon monoxide and alcohol. Common colds, indigestion, minor stomach disorders may slow up the driver's ordinarily quick perception of highway hazards. Headaches, toothaches, body sores or injuries, sunburn, hay fever, sore throat and the undue effects of temperature are all in the category of these minor illnesses which affect driving skills adversely. Tight, ill-fitting or restrictive clothing has similar results. It would be too much to expect anyone to refrain from driving because of any of these minor discomforts; the point is that the driver must be made aware of the fact that they weaken his abilities, and that he must compensate for them. Driving is a matter of constant alertness and quick reaction; we must not allow it to be affected by disabilities either large or small.

DRIVING HABITS—GOOD AND BAD

After a reasonable experience in driving, most people move their foot from the accelerator to the brake pedal automatically, and they shift gears with a kind of sixth sense. They have arrived at a point where they need not think out each minor movement in complete detail; it has become a matter of good habit,—the surest sign of quickened reaction time, the road to safe driving.

EARLY TRAINING—In operating a car, habits can be put to extraordinarily good use for an automatic action in the

nick of time may avoid a collision, save a life, or prevent an injury. Good or bad, they are acquired early. The beginner, for example, should practice repeatedly the fundamentals of driving—the use of the clutch, gear shift and brakes. After a thorough grounding in these at some place where there are few other cars to distract him he may venture forth in moderate traffic. Then, under competent instruction and with the exercise of much thoughtfulness, he should build a good set of habits regarding traffic lights, making turns, passing other cars, controlling his speed to suit conditions and other vital principles of safe driving. While these habits are forming he will be slow and, therefore, his early experience should be acquired at extremely low speeds,—say twenty miles an hours or less. Later, when he has complete mastery of the car, he may travel faster with safety.

Bad habits may develop with the good, and if anything they are more difficult to get rid of. For instance, in order to be prepared for all emergencies the timid learner may keep his foot on the clutch pedal, committing thereby an act commonly called "riding the clutch." This is certain to prove harmful to that mechanism, and if his instructor fails to correct this timid gesture, what was once a commendable evidence of caution may crystallize into a destructive and costly habit.

Few people recognize their own bad habits; if they did their natural impulse would be to set about immediately to correct them. A striking demonstration of this was given at a recent meeting called by a police department for the purpose of teaching accident-prone drivers how to avoid collisions. Discussion centered for a time on safe practices at intersections, and one of the group made an extensive talk on the subject. It was evident that he had given the problem considerable study for there was hardly an eventuality that could possibly take place at an inter-

section for which he did not advance some sound, sensible solution. The police officers were amazed. How did this man find himself in an accident-prone group? They studied his record and discovered the answer. All his accidents had taken place *between* intersections, for he was convinced that the only place at which he needed to exercise care was at crossings.

HOW TO BREAK BAD HABITS—It takes will and concentration, but bad habits can be broken, and the first step is to find out what yours are. Take an experienced driver along on a ride with you, and ask him to analyze your driving faults quite candidly. Act accordingly, because he will probably be ninety-nine per cent right. Another way is to analyze frankly for yourself what it was that forced you into an accident or a near accident. At the root you may discover a glaringly bad habit. Remember this about accidents: in collisions involving two cars, it takes two drivers to make an accident. A careful study of typical accidents will reveal the fact that, while one driver was principally at fault, the other could usually have avoided the mishap by quick and intelligent action. Nearly three-quarters of all accidents, authorities estimate, involve partial blame for both drivers.

Careful training and a constant effort to improve his skill will produce a driver whose good habits will make him able to operate his car without scraping a fender under even the most difficult and trying conditions. Such a driver acquires a sixth sense which keeps him out of traffic trouble. It is not uncommon to find a person who has driven many hundreds of thousands of miles without having had an accident.

PREPARED DECISIONS—Prepared decisions are those you should make at your leisure and file away in the card index of your mind ready for instant use the moment

unusual or trying situations arise to demand them. They are the guides which impel you to do the right thing, for instance in bringing your car out of a skid—to steer in the direction of the sideways motion. The instant you feel your car skidding, the prepared decision should pop out of your mental file. It will inevitably reduce your thinking time in a real or close emergency.

Prepared decisions differ from fixed habits in that the latter are automatic, the result of repeated action; the former must be carried out with conscious effort, the result of rare use. The good driver collects prepared decisions in a variety of ways. He reads books or articles on good driving; he learns common sense rules from other motorists; he studies accidents, examining their causes and methods of prevention; he hears others explain how they escaped from unusual situations; and he checks and rechecks his own record with a determination to improve it.

This is all similar to the technique that creates champions in sport. A champion studies his opponent's skill before meeting him in competition so that he can decide in advance that "If he does this, I shall counter with this." Good football coaches spend plenty of time in blackboard drill to explain all possible moves of the opposing team and to train their own team in the proper action to take and the precise moment at which it should be taken.

These are all prepared decisions. By collecting and employing them drivers are able to deal with situations they never encountered before. The man or woman, boy or girl, who knows in advance what to do to overcome an emergency is superior to the quick thinker who, lacking prepared decisions or emergency habits, must plan his campaign on the spot.

ACCIDENT-PRONE DRIVERS

We approach now the problem of the driver who violates most of the principles set forth in this chapter,—the "accident-prone driver," the person who has accidents quite as consistently as others avoid them. According to Sidney Williams, of the National Safety Council, the reasons for the existence of this prone-to-accident fraternity may be divided into three general classes: First, some people lack the necessary fundamental capacities for safe driving: they are too weak; their eyesight is hopelessly bad; their intelligence is sub-normal; they cannot judge speeds and distances; they are unable to concentrate; they react too slowly; they are clumsy and awkward. Second, some have acquired bad driving habits: they manipulate the controls incorrectly; they ignore common hazards; they repeatedly make an error that places them in troublesome situations. Third, some have bad mental attitudes: they want to show off; they are tense or impulsive; they want to be the fastest on the road; they are ill mannered; they derive pleasure from annoying others; they are inconsiderate and selfish.

Some of these drivers have as many as six mishaps a year, while even the ordinary motorist drives twenty years on the average without an accident. It is the existence of this class of accident-prone drivers that accounts for the fact that fifteen per cent of the drivers on the road

are responsible for a majority of our accidents. In the face of such evidence can they be called a "hard luck" group?

One of the serious problems in traffic control is to know what to do with accident-prone drivers. Studies both in

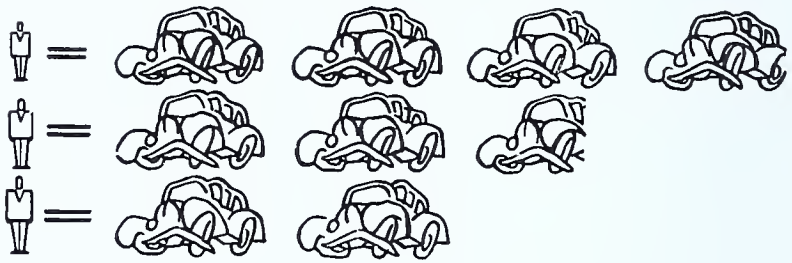
the traffic field and in the industrial field show that some accident-prone persons can be re-educated. Some further research is needed before the exact proportion can be determined. There is a certain percentage of drivers, however, that are hopeless; an adequate driver's license law should keep them off the roads.

ARE WOMEN WORSE DRIVERS THAN MEN?

A popular controversy rages over the question: are women worse drivers than men? According to available statistics, the answer is: No. An analysis of the records of 7,600,000 licensed drivers reveals that in one year one man in every twenty-one had an accident while the corresponding figure for women was one in ninety. One male driver in 726 was involved in a fatal accident; one female driver in every 3,558. If these statistics are accepted uncritically, they indicate that the average man is four times as likely to have an accident as the average woman, and five times as likely to have a fatal accident. It must be remembered, however, that men drive more than women and under more hazardous conditions. They operate trucks, buses, taxicabs, and business requires them to make long trips in all kinds of weather. To obtain a true comparison one needs to study the records of men and women who both used the same type of equipment over the same routes. Such a record is available for a group of Pennsylvania cab drivers. It reveals that women have more accidents but less serious ones than men.

THE RECORD OF YOUNG DRIVERS

The young driver is the poorest driver on the road, according to accident records. Persons under twenty years of age have thirty-nine accidents for every thousand licensed drivers, while those between thirty and thirty-nine have twenty-seven accidents for every thousand



licensed drivers. Persons between forty and forty-nine have only twenty per thousand.

There is no physical reason why younger drivers should not excel in driving skill; they are quicker, stronger and more agile. They are interested in driving, and apparently want to know all there is to know about cars. The principal reason for their bad record is that they lack judgment,—they fail to appreciate hazards. Because they display a show-off, reckless attitude, they place themselves in dangerous situations that a more experienced motorist would avoid.

CHAPTER V

THE DRIVER—HIS PSYCHOLOGY AND HIS ATTITUDES

THE psychology of man—his ability to concentrate, his tendency to be distracted, his fears, worries, quarrels, his desire to show off, his many other mental quirks, attitudes and limitations,—all have a profound influence upon his skill as a driver. Either they provide him with superior qualifications or they disturb and hinder him. In either case if he is to be a good driver, he must master them as he does the habits and physical limitations described in Chapter IV.

It is obvious, for example, that the driver who concentrates his attention on the road is essentially superior to the one whose mind wanders from the job before him. Similarly, any experienced driver knows he operates his car less skillfully, often with less efficiency when he is tired than when he is fresh and rested.

DRIVING IS A FULL-TIME JOB—In the first place driving is a full-time job. It requires concentration and requires it continuously, for all the characteristics of road travel, for warning signs and signals, for pedestrians, for road

conditions, curves, hills, blind corners, and all the actual and probable movements of other cars. Authorities on accident records say that inattention, the lack of concentration, is the second most frequent cause of motor mishaps, being next in line to driving too fast. How often traveling along the open highway one sees startling evidences of inattention! There are drivers who carry on animated conversations with their companions, gesturing and bobbing their heads over an exciting topic; there are others who study interesting scenes or objects along the side of the road. These lapses may last only for a second, —but remember the car's long nose, growing longer and longer the faster it goes. It is measured in length by the braking distance and reaction time required to bring the vehicle to a stop, and, as we explained in Chapter IV, this is eighty-three feet at thirty miles an hour, and two hundred and sixty-four feet at sixty. Thus, anything can happen in a second.

Take the case of the chauffeur who took three young children and their teacher out for a pleasure trip. Along the way the party stopped to pick wild-flowers and ramble in a field. They placed the flowers in the seat alongside the chauffeur, and on the way back he attempted from time to time to arrange them in a neat bouquet. Once when his gaze was only momentarily from the road, the car struck a culvert, hurtled through the railing of a bridge and landed in a stream twenty feet below. All in the car were seriously hurt. What price inattention!

Inattention undoubtedly accounts for many otherwise unexplainable accidents, such as the one which recently killed fourteen school children and injured several others in a crash at a railroad crossing. It was a foggy night, and the driver who had fallen into the bad habit of slowing down but not stopping for the crossing repeated his

error. Later, he testified there were no warning signals calling attention to the approaching train. Others said the signals were plainly visible. Was the cause inattention, bad habit, or both?

Alertness and attention are such obvious keys to safe driving that many an experienced driver will wonder why we continue to dwell on them. The reason is that attention is the prime requisite of good driving, and inattention is sure to produce an accident sooner or later. An odd proof of the virtue of attention and alertness is the strange fact that accidents often are found to be less numerous in bad and slippery weather. Drivers appear to concentrate all their skill on avoiding mishaps under these conditions. Why not extend this super-attention to *all* kinds of weather?

DIFFERENCES IN OUR ABILITY TO CONCENTRATE — Some people have the gift of being able without effort to keep their minds on a subject for long periods of time. Others find it impossible to concentrate for more than a few minutes before seeking relief in mental wool gathering, dreaming or other diversions. The latter have great difficulty in becoming good drivers, for a good driver cannot permit himself to be distracted. Check yourself for this fault, and you may be able to correct it. Make a business and an art of driving; it should engross your attention.

PERSISTENCE OF MEMORY — Unpleasant or shocking experiences often remain vividly in one's mind for long periods of time even though one sincerely wants to forget them. Psychologists describe this mental quirk as "perseveration"; it definitely lowers the efficiency of any driver. If a man has just quarreled with his wife, or if he has just witnessed a bad accident or some other disturbing sight, he is likely to be in an impaired condition

as a driver. The perseverance of the incident divides his attention and splits his ability to concentrate. Good drivers know this phenomenon and learn to compensate for it.

TRYING TO ATTRACT NOTICE—Accident situations are frequently created by drivers who attempt to attract the attention of friends, acquaintances or passersby on the sidewalk or in other cars. Unless they pull over to the extreme right and stop, their cars are likely to slip completely out of control during the time they are trying to make their presence known.

AUTOMATIC DRIVING—Experienced drivers sometimes suffer from "automatic driving," an affliction which permits them to drive for long periods though concentrating on other problems. Their good habits help them through ordinary contingencies, but a real emergency catches them off guard.

A veteran bus operator had this fault. For seven years he had driven over the same road day in and day out so that he actually knew every inch of the way, and felt he could drive it blindfolded. Along the way there was one blind intersection and on approaching it he invariably slowed down to about ten miles an hour, increasing his speed again as soon as it was safely passed. Thousands of times he repeated the process and never met a car. One day he was occupied mentally with some personal problem. As he came to the intersection he automatically slowed down and then speeded up again, but as he increased his speed he crashed into another car that had darted out from the intersection at forty miles an hour.

ONE-ARM DRIVING—One of the driving conditions where inattention is particularly in evidence is the bad practice of one-arm driving, and it is not surprising that many states have outlawed it entirely. At best the driver's

attention is divided between the road ahead and whatever he may be doing with his other arm, and often it is what he is doing with his other arm that gets most of his attention. It is true there are few driving problems requiring the absolute presence of both hands on the wheel, and yet when they occur they are imperative, as starting on hills, manipulating lights and giving hand signals; more important, however, are the emergency situations involving such things as near accidents and blowouts. The driver who indulges constantly in one arm distractions is not prepared in an emergency. He cannot react quickly to trouble. Furthermore, he is likely to drive at excessive speeds and to manifest other show-off tactics. He is definitely not a good driver.

ROAD SIGNS—However necessary they may be, road signs are distractions until the driver is experienced enough to read them without placing himself and others in jeopardy. In strange territory motorists are on the lookout for direction signs to guide them, and in many cases, because these signs present long lists of towns, mileage and other details, they require plenty of reading time. You cannot scan them accurately on the fly; if you try, you may go several miles out of your way, on the wrong road, or create a serious accident situation. The best procedure is to pull over to the right and stop; it will save you time and danger in the long run. If you look

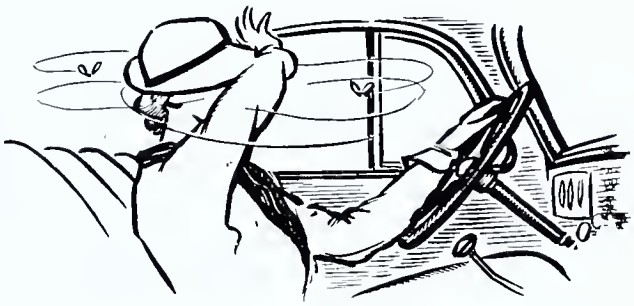
at advertisements along the road you must do so with care and discretion, for to the degree to which such advertisements are successful they are distracting.

AUTOMOBILE RADIOS—Despite differences of opinion on the subject of automobile radios veteran drivers agree (1) that tuning in an automobile radio while the car is in motion involves a hazardous division of the driver's attention; (2) that distraction and division of attention is certain, if the program consists of talks or speeches or broadcasts of sporting events such as baseball and football games, races or prizefights; (3) that the radio should be shut off in dense traffic.

Some people insist that radio in motor cars is so distracting to the driver as to be a real menace, and they blame it for a large number of present-day accidents. Others maintain that distraction depends on the type of program heard. Jazz music, being stimulating, may excite some drivers to go too fast while slow music may have quite an opposite effect. On the ground that radio is helpful to the driver who has no companion, especially on long trips (keeping him awake for one thing), radios were recently installed in all the long-haul trucks of a large commercial fleet.

The radio problem is an individual responsibility; if radio affects your driving adversely, you should not have it in your car; if it helps you, it may be worth while. In any case the quality of the driving, not the radio, is of primary importance.

DISTRACTING INSECTS—Like the ancient Greeks of Sparta or the stoical Indians of our own country, drivers must learn to keep calm under many trying conditions. Perhaps the worst of these conditions is when an irritating insect such as a mosquito, a wasp or a bee flies in through the window while a car is in motion. In spite of an



almost irresistible impulse that will arise to make you kill the invader at once, you must withhold your attack until the car is brought safely to a complete stop. Otherwise you may repeat the following unfortunate experience: A woman was driving along when a bee flew in and stung her on the cheek. She slapped at it, knocked it to the floor, and then looked down to see where she should finish the job with her foot. As her glance was on the floor, she steered unconsciously to the left crashing head-on into another car.

FATIGUE—Fatigue, or the state of being downright tired, is the cause of more than 70,000 accidents annually and a subtle factor in many others. Worst of all, such mishaps are always serious and often fatal because when the driver dozes off or falls asleep his car is likely to run off the road at high speed. One motorist who survived such an accident said he had been driving almost continuously for two days. At the critical moment he nodded, his car ran off the road and plunged down a deep ravine.

WHAT CAUSES DROWSINESS?—Prolonged driving is not the only cause of fatigue among drivers—one operator involved in such an accident had been at the wheel only half an hour. The most important reason, of course, is the excessive number of hours that have elapsed since the individual last had sleep. Some people become drowsy,

however, if they are up past their normal bedtimes, others are affected by overeating or digestive sluggishness, others by sitting too long in one position, by a noisy motor or by eyestrain. Alcohol and carbon monoxide play a sinister part in making a driver drowsy, as do extremes of heat and humidity.

HOW TO AVOID FATIGUE ON A LONG TRIP—Two common sense rules will help you avoid fatigue on a long trip:—"Get Plenty of Sleep" and "Eat Sparingly." Adjust your trip schedule so that both the driver and his passengers can enjoy regular rest periods. Some experienced automobile tourists stop five minutes every hour, get out, exercise and fill their lungs with fresh air. If there is more than one driver in the party, one rests while the other takes a turn at the wheel. Above all, if the driver grows sleepy, he stops the car safely at the side of the road and takes a nap.

Discomfort in seating arrangements can be anticipated in advance and if his seat is adjustable, the driver can plan on a series of changes to avoid the fatigue that comes from sitting continuously in one position. Passengers can change seats with each other. In between these rest periods the good driver saves his strength by driving at a pace that "feels good." Whatever speed permits him to take a relaxed posture should become his average; not one that keeps him crouched tensely over the wheel.

MENTAL ATTITUDES

Do you think every highway is a race track, that the outstanding virtue of an automobile is sheer speed? Does driving bore you? Do you like to compete with other motorists in spectacular feats of driving? Do you enjoy keeping other people behind you even though you must be a road hog to do it? Are you irritated when forced to wait a safe opportunity to pass another car? Do you become annoyed when someone discovers you in an error of driving judgment?

Your answers will determine the degree to which you have safe attitudes and to a very great extent your status as a good driver. A constant improvement in your point of view will make you a correspondingly better driver.

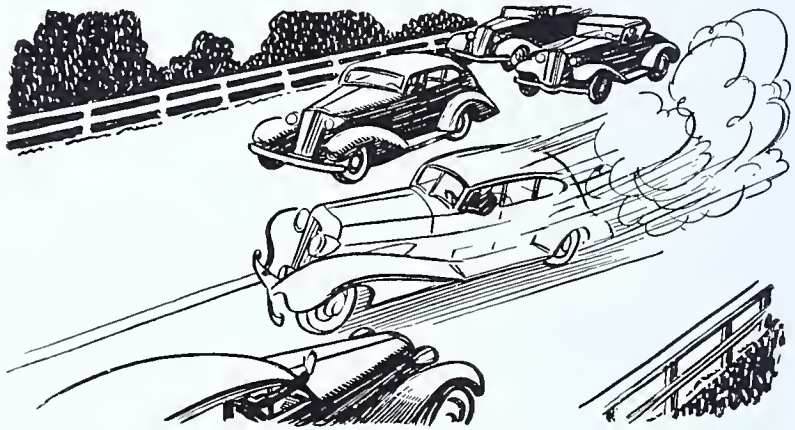
THE "HURRY" ATTITUDE—Anything to save a few seconds—such is the attitude of the man or woman who is always in a hurry, usually to reach unimportant destinations. There was a man, for example, who drove home like mad every night. His trip was a continuous nightmare, exhausting him far more than his day's work. When he arrived home, he regularly spent half an hour on a couch recuperating from the effects of his witless dash. One day he asked himself "Why?" and on checking up found that his hurry saved him less than five minutes.

LETTING DOWN—Those who have the hurry mania often suffer a serious let-down in driving ability when they try to drive at a slower pace. They cease to be attentive and grow careless as opposed to their tense alertness at high speed. Drivers with such one-track minds cannot qualify as good drivers until they have acquired a more balanced attitude.

THE COMPETITIVE ATTITUDE—A burning desire to lead the pack is responsible for thousands of the most serious

accidents. Drivers who are animated by such desires feel that by stepping on the gas and by taking unnecessary chances they prove themselves better drivers and better men. They forget the dull fact that all that needs to be done to make a car go faster is to increase pressure on the accelerator.

THE SHOW-OFF—The competitive attitude frequently develops into a bad case of show-off mania, an affliction everyone knows and pities. The poor show-off, eager to startle and amaze, involves himself in a series of narrow escapes; he drives too close to other cars, he weaves in and out of traffic lanes, he is continually taking foolish chances with his own and other lives. Taking chances becomes habitual with him, he becomes more daring and less intelligent, until at last the inexorable law of averages shows him up for what he is, an inferior driver and a menace to others.



ROAD HOGS—There is a disagreeable type of person who thoroughly enjoys annoying others. He is not the harmless teaser, but a dangerous, pathological person for whom road hogging and similar discourtesies serve to inflate the ego. Making pedestrians scramble for their lives and

forcing other drivers into the ditch give him the feeling that he is a "big shot." Beware of him and of imitating any of his tactics.

WAITING TO PASS—Waiting to pass a slow-moving vehicle ahead is an experience every driver has had and one which frequently develops into an unreasonable annoyance. Often the impossibility of executing a safe manoeuver around the car ahead because of curves on hills exasperates the otherwise careful driver to such a point that he throws caution to the winds and goes round at all odds.

When you find yourself in similar circumstances you can avoid such an annoyance by placing a greater distance between yourself and the car ahead. Then you can drive leisurely and peacefully along until the first safe opportunity to pass presents itself.

ATTITUDES TOWARD THE LAW—An old cynicism "laws were made to be broken" is nowhere more evident than among that fringe of drivers who become models of pro-

priety when a patrol car or a motorcycle policeman swings into view. As soon as the officer disappears from sight, the model conduct of such drivers dissipates in thin air. Again when they are discovered in some violation of the

law or error in judgment they become cross and argumentative with the arresting officer. They insist they are right and he is wrong, they accuse him of unwarranted interference, and exercise other bad judgment and bad taste. Both attitudes are childish and not characteristic of the good driver.

BOREDOM—Whenever you hear someone boast of his prowess at covering the longest possible distances in the shortest possible time, you are probably listening to the bored driver who has to have that kind of dope in his veins to make up for his lost interest in the art of driving. Like automatic driving, the bored attitude is usually the result of too much driving over the same territory. Bus companies report that after four years a driver's efficiency begins to lag, necessitating all kinds of contests to reawaken his interest. The companies conduct safety competitions, interchange routes, and employ other means to guard against the weakened abilities of the bored driver. Take a tip from them. Best of all make driving an art, one in which you can constantly improve, and you will not get bored.

LICENSE TESTS

It may surprise you to learn that some twenty-four states have no drivers' license laws at all. In such states a lunatic, or a person who is hopelessly handicapped physically, or one who mentally could never learn how to drive safely, or a man with an utterly vicious antisocial attitude may all exercise an unrestricted right to operate high-powered cars on the public highway. In six states having even no minimum age limits a child may step from a sidewalk scooter to the wheel of a hundred horsepower automobile without violating any law. Such conditions contrast strangely with the exhaustive care taken by railroads to train locomotive drivers even though locomotives

run on fixed tracks, or prearranged schedules, and with the protection of all the mechanical devices human ingenuity can invent.

In states where drivers' license laws exist there is a great variation in the quality of the law; the conditions of some are drastic, of others perfunctory. The ideal law requires an extended road test as well as an examination of the applicant's understanding of traffic laws and rules and regulations and a formal check of outstanding physical qualifications such as eyesight and hearing, together with strict disciplinary measures to see that a high standard of driving excellence is maintained.

Through the road test the examiner learns the driver's habits and attitudes and the extent of his skill at handling a car in traffic. The applicant must start his car on a hill without allowing it to roll backward, he must make right and left turns properly into express highways; and he must conduct backing manoeuvers to show that he has good control over the car in reverse. The road test undertakes in addition to discover whether the driver can stop quickly in an emergency, steer well, and think rapidly concerning a dangerous situation.

The examination should include a written or oral test to find out whether the applicant knows the rules of good driving, understands the salient features of automobile mechanism, and is familiar with traffic laws.

CHAPTER VI

HIGHWAYS

THE gentleman who motors comfortably over miles of super-highway today in his hundred horsepower automobile has little occasion to compare his easy mobility with that of his Pilgrim forefather. His mind is occupied with other things. Yet, if some strange stroke of magic were suddenly to unfold before his eyes the astonishing panorama of roadbuilding since the day Colonial settlers blazed trails through the wilderness, he might well wonder at the enormous debt which civilization, and particularly the automobile age, owes to roads.

For when the early men of Massachusetts and Virginia traveled from settlement to settlement, they followed not roads, but axe scars on the forest trees, Indian trails or navigable waterways. Later they cleared paths and trails of stone and underbrush and widened them into crude roads, "corduroyed" in places, for the use of the horses and pack animals that were arriving in sailing ships from England. Such roads as there were ran mostly north and south, lengthwise of the narrow strip of land that the Colonies occupied along the coast. For the 150 years that preceded the Revolution, real roadbuilding was, however, a neglected activity.

Instead of being taken overland, where the perils of wild beasts and hostile natives were certain to be encountered, passengers and freight were transported chiefly in packets and other sailing vessels. You will remember that the stripling Benjamin Franklin arrived in Philadelphia after a stormy voyage from Perth Amboy in a tiny sloop, and that the sea was then such a thoroughfare that piracy and smuggling flourished not merely on the

Spanish Main but along the coast from New Bedford to Savannah. In 1776, one major highway connected the most thickly populated area along the middle Atlantic, running for the most part over that route from Boston to Baltimore which is now "U. S. 1," the most extensively traveled highway in the United States.

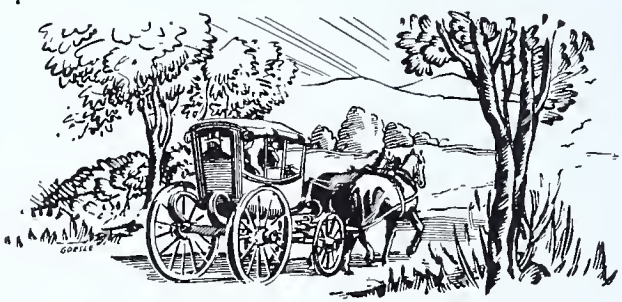
Spreading ever out and westward, the new Colonies began to yearn for roads and still more roads. General Forbes, about 1760, constructed a military highway from Philadelphia to Fort Duquesne, now Pittsburgh, and not long after, Daniel Boone opened Boone's Trace, or the Wilderness Road, through Cumberland Gap farther to the south. This became at once the gateway to the Middle West, and caravans of emigrants surged over it into that rich, fertile land beyond the mountains.

During the winter and spring, highways became almost impassable, they were so choked with snow and ice or

mud and muck. It was an important event when in 1792 a sixty-five mile stretch of turnpike between Lancaster and Philadelphia was surfaced with broken stone. Ten years later, road conditions were so much improved that a regular freight and stagecoach service was operated between Boston and Savannah, a distance of 1200 miles. True, the trip took twenty-two days at an average speed of fifty-three miles a day, but there were plenty of hospitable taverns along the route to look after the traveler's needs for food and sleep.

Private companies built the best roads in the country; these companies erected toll gates along the routes and collected fat fees from the travelers and freighters who used them. The roads were particularly good in Pennsylvania, where by 1828, many fine bridges and over three thousand miles of turnpike had been built. This was one of the reasons why that Commonwealth dominated the early Western market.

Still the pressure of emigration kept on. By 1806, Congress had appropriated funds for the construction of the "National Pike" to ease movement into the "new Northwest country." This highway stretched from Cumberland, Maryland, over the Appalachian mountains, to Wheeling, West Virginia (then in Virginia), the basis today for one of our chief transcontinental highways, "U. S. 40."



TRAILS TO THE WEST—The National Pike was only the beginning. In rapid succession, along came such romantic names as the Santa Fé Trail, the Oregon Trail, the California Trail and the Mormon Trail. The routes which bore these names became famous almost overnight as the pioneers pushed indomitably westward. Santa Fé, in 1832, was a raw Mexican trading post; the Santa Fé Trail ran between Santa Fé and our farthest Western outpost at Independence, Missouri, and it was over this road that American-Mexican commerce was started. When Lewis and Clarke opened the Oregon country in 1842, hordes of emigrants streamed over the Oregon Trail, braving the hardships of blazing sun on salt deserts and the frigid climate of snow-packed mountain passes. The path over which they sweated and bled still survives and now is also a part of "U. S. 40." The Mormon Trail ran from Illinois to Salt Lake City.

Perhaps the most riotous, roaring and celebrated of all, the California Trail, grew out of the pell-mell rush for gold in 1849. Then, indeed, the huge Conestogas or covered wagons, rumbling over the prairies in never-ending streams, became the picturesque symbol of daring frontier spirit and highway travel. Roads became a prime economic factor in the life of the nation, East as well as West, and their history is studded with gems of song and story.

THE RAILWAY—Then the railways burst upon the scene, bringing to an end the first great era of roadbuilding. Travelers and freight alike deserted the stagecoach and the canal for the faster, more dependable railroad, and the highway system, neglected, fell into comparative disuse.

THE BICYCLE—This state of affairs continued until the bicycle seized the imagination of the Gay Nineties and stimulated a new urge for better roads. Cycling became a national sport, but the dips, bumps, curves, mudholes and ruts which the horse and wagon were able to endure were a real peril to the cyclist. The development of the sport led to the organization of local wheel clubs, and, finally, in 1887, of the League of American Wheelmen, which began and carried on for years a successful campaign for improved highways.

INFLUENCE OF THE MOTOR CAR—If existing roads were bad for cyclists, they were infinitely worse for the new motor car. They went to pieces under the increasing motor traffic, and particularly through the pounding of heavy motor trucks during the World War. It was evident that old roads could not be patched up to stand this new strain; an entirely new highway system, constructed on new principles, was needed. Automobile manufacturers took a lead in furthering this development, investing great sums in engineering study and promotion.

FEDERAL AID—At first roadbuilding was the responsibility of cities, towns and counties, but in 1893, New Jersey headed a parade of states in deciding that the business of roadbuilding should be administered by a state highway department. In 1916, the Federal Aid Road Act brought the federal government on the scene with the avowed purpose of designing a system of interstate roads. Through the United States Bureau of Public Roads in the Department of Agriculture, the government offered

to carry one-half the cost of certain state road projects provided the state established a highway department and employed a competent engineering staff. The project succeeded, and in 1921, Congress created the Federal Highway System; seven percent of all state roads were made eligible for federal aid. The system now embraces more than 190,000 miles of highway.

OUR MODERN ROADS—Rapidly as they have worked, roadbuilders have not kept pace with the increase in road travel. In thirty years the average vehicle speed has jumped from five to forty miles an hour, while the total number of vehicles in use has increased by nearly 10,000 per cent. Nevertheless, we now have more than three million miles of roadway in the United States, nearly one-third of which is improved highway; the other two-thirds is chiefly dirt-surfaced road. Today the trend in road construction is toward super-highways built to accommodate high-speed motor cars with safety and comfort.

PLANNING A HIGHWAY

It would be silly to construct a costly highway where few would need to use it. That is why modern roadbuilders attempt to foresee not only where traffic requires a road for immediate use, but where it may need one in the near future. State and federal plans for expansion are considered, traffic counts and population trends are studied, the development of industrial centers and the probable changes in adjacent highways are predicted. Then, if the project is decided upon, land for the right of way is purchased. Provision is made so that the right of way will be wide enough to permit the expansion of the highway if future traffic requires, and in many cases, to permit landscaping. Many of the finer and more modern highways restrict, and some of them prohibit, the use of advertising billboards and road-side stands. Where

a highway is to be a main artery between two large cities, it is built to avoid towns, in sharp contrast to the old custom of pulling the "State Road" on through every Main Street. The latter procedure delayed through traffic, caused congestion in the business centers of town. It inconvenienced and endangered local residents by exposing them to the great number of cars that were merely passing through.

After the plans for such a road are made, many operations get under way at once. The right of way is cleared and leveled. Bridges and culverts are built, usually wide enough, in anticipation of future needs, to provide for additional lanes. Wherever traffic is heavy enough to warrant the expense, road surfaces are made waterproof to avoid the disadvantages, both physical and psychological, of roads that require elaborate drainage systems. Roads of the old type were built high in the center to permit water to flow down into deep drainage ditches at the side. Skidding on such roads is a constant hazard during wet weather, and furthermore, the force of gravity pulls a car from a high-crowned center toward the lowest point, the ditch. As a result, motorists are inclined to straddle the curve in the center and ride in the middle of the road in violation of one of the cardinal principles of good driving.

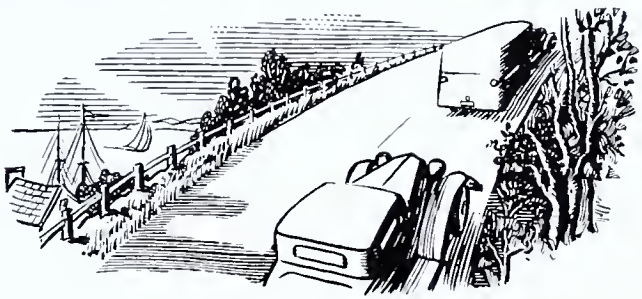
Today the best roads are being made perfectly flat, with a wide, unpaved surface called "the shoulder" running alongside. At the outer edge of the shoulder ditches are built as shallow as good drainage will permit in order to lessen the possibility of serious damage if a car is forced off the road. The shoulder also provides a space in which cars can pull off the highway if the driver wishes to park or make repairs.

THE ROAD SURFACE—The best pavement is one that is hard and gritty because it furnishes a high degree of fric-

tion for tires and is not likely to be slippery when wet. Concrete can be roughened by a process called "brushing" which forms little ridges in the surface when the mixture sets, while asphalt pavements can be studded with small pebbles. Even when the road is thoroughly wet, these ridges and pebbles keep it from becoming slippery.

On dirt or loose gravel roads there is less friction for tires because these substances roll under pressure, causing the car to skid if the driver makes a quick stop or a sudden turn. Dirt roads are also slippery when wet. Roads constructed of creosoted wooden blocks are especially dangerous under such conditions, providing not much more tire traction than a sheet of ice.

VISIBILITY ON HILLS—Anyone who has ridden in an automobile appreciates the fact that visibility on an upgrade is sharply limited: you can't see over the top and down the other side! Therefore, good drivers religiously keep to the right, and control their speed so that an emergency stop can be made, if trouble develops on the crest. If



you are held up on a hill behind a slow-moving car, a truck or a bus, by all means wait until you have cleared the top before you attempt to pass. In many states passing near the top of a hill is unlawful; in all states it is dangerous. Anything higher than the driver's eye-level cuts off his range of visibility and should be treated as a hill.

This places a small rise in the same class as a mountain as far as assured clear distance ahead is concerned. Hills always introduce an element of danger. In order to reduce this danger some of the more modern highways are graded like railroads: deep passages are cut through hills and shallow valleys are filled.

CURVES AND CENTRIFUGAL FORCE—Highway engineers are working to eliminate curves wherever they can and to reconstruct those that are absolutely necessary so as to make them as gradual, wide and well-banked as possible. For curves, like hills, limit the driver's ability to see ahead; furthermore they bring out the dangerous effects of centrifugal force. On a car trying to round a curve centrifugal force exerts the pressure of a giant hand, sometimes pushing it off the road or causing side-sway and skids. To counteract this force curves are "banked": the road is built on a slope, the outer edge being higher than the inner, so that the force of gravity tends to draw the car toward the inner side, thus tending to counteract centrifugal force. Centrifugal force, at the same time, is harnessed to make it perform the useful service of pressing the tires more firmly against the surface. Curves that are not banked must be taken at very moderate speeds.

However, engineers have not yet been given the opportunity to rebuild all curves and many sharp turns and bends still exist on the majority of our highways. Good drivers learn to judge quickly the sharpness of such turns and they regulate their speed to prevent side-sway and skids. No passing is ever attempted on curves; the good driver follows the car ahead until the curve is rounded and passes only when there is sufficient clear distance ahead.

RAILROAD CROSSINGS—The railroad grade crossing—the place where trains and automobiles cross at the same level—is another threat to good motoring. Road builders

are trying to eliminate grade crossings, but this is a giant task, for at present there are more than a quarter million such spots throughout the country. Crossings are plainly marked with a distinctive sign—either by two boards crossed in an X or by a circular marker bearing a heavy black cross and the letters RR or by other means. Some crossings are guarded night and day by watchmen who stop traffic as the train approaches or by a system of mechanical gates or signals.

Until such crossings can be eliminated by underpasses or overpasses, the task of preventing mishaps is every driver's own responsibility. It is the car that strikes the train, instead of the train that strikes the car, in one-fourth of all grade-crossing accidents every year. Trains, being infinitely heavier and harder to stop than an automobile, have a clear right of way at crossings. The good driver slows down, or preferably, stops, and looks both ways before proceeding across the tracks. Passenger busses in most states are required by law to come to a full stop. The driver must not only look both ways, but must open the bus door and listen to make certain that no train is approaching before he proceeds across. In some states he is required to get out and look both ways down the track. Having encountered a train at a crossing, and having waited for it to pass, good drivers have one more trick up their sleeves to prevent mishaps. When crossing double tracks, they wait to make certain that another train is not coming in the opposite direction.

MODERN HIGHWAYS

Dense traffic is developing a new, vastly more expensive "super-highway" designed to carry heavy traffic at high speeds with comparative safety Engineers believe such highways will materially reduce accidents of the four major types, which have been found to be: head-on colli-

sions, accidents in passing, accidents due to parked cars, and accidents resulting from the cross-flow of traffic. Dr. Miller McClintock, Director of the Bureau for Street Traffic Research of Harvard University, has analyzed these hazards in an illuminating way by comparing the flow of traffic on highways to the flow of water through a pipe.

HEAD-ON COLLISIONS—Just as it is impossible for streams of water to flow both ways through a pipe without interference, so it is impossible for streams of traffic to move in opposite directions on the same road without interference. This shows itself in the existence of head-on collisions and side-swiping accidents. On a modern super-highway the two streams of traffic are separated by a raised "medial strip"—a curb or park area six feet or so wide, built down the middle of the road.

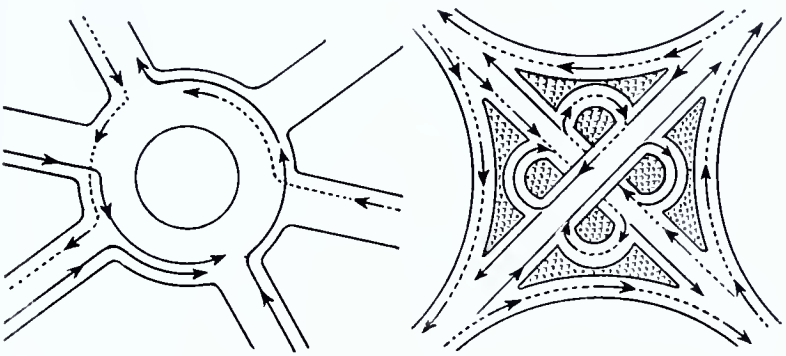
PARKED CARS—If a pipe were narrower in some places than in others, it would cause irregular eddy currents and hamper the free flow of water. In the same way parked cars make the effective width of the road irregular and produce currents in the stream of traffic that reduce traffic efficiency. Parking is prohibited on super-highways.

PASSING—An object which moves slower or faster than the stream of water in a pipe produces conflicting currents. Similarly, when cars on the road move at different speeds, the faster vehicle must swing from one lane to another to overtake and pass the slower one, thus increasing the possibility of side-swipes. Traffic engineers have, therefore, set up maximum and minimum speed limits, and recommended that all cars on super-highways travel at the same rate. Special lanes are provided for cars entering the highway to give them time to adjust their speeds to the general pace.

INTERSECTIONS

Two streams of water cannot flow through each other. In traffic at crossroads a similar situation prevails; two principal types of intersections have been devised to take care of this difficulty: the traffic circle and the grade separation.

TRAFFIC CIRCLES—The traffic circle or "rotary" is used to best advantage at intersections where more than two roads meet. Instead of moving in a straight path through the intersection, all traffic is made to move in the same direction, at a reduced speed, around a circle which connects all roads leading into the intersection. On reaching the circle a car turns right and joins the general parade until it comes to the road by which it intends to leave, then turns to the right again and out. The traffic circle is a remarkable device; it eliminates with the greatest simplicity most of the confusion that is caused by cross



traffic and turns at intersections. Its only disadvantages appear to be that it requires a large space in order to allow cars to work easily into the outer lane and that cars must slow down on approaching it.

THE GRADE SEPARATION—The other method of avoiding the cross flow of traffic is to build the intersecting

roads on different levels and to carry one over the other by means of a bridge. The clover leaf is the most familiar device for securing such a grade separation; there is a drawing of it on page 91. To move from one highway to the other on the clover leaf, cars make right turns only on curving side roads; two of these roads are located on each side of the main artery. To make a left turn from one highway to the other, a car proceeds beyond the intersection (under or over the bridge as the case may be) and then turns off to the right on the first side road. By describing a quarter circle, the driver in a moment finds his car moving in the same direction as if he had made a left turn on an ordinary intersection.

OTHER INTERSECTIONS—Not all intersections are or need to be as elaborately planned as those described above. Nevertheless, all crossings present difficult problems and the driver needs to have all his mental cylinders working as he approaches them. He must have his car under complete control and be ready for an emergency stop, if another car darts out from the cross road. Visibility along both sections of the cross road determines the safe speed at which the approach should be made. If it is perfectly evident that no cars are approaching from either side, speed may be adjusted accordingly, but if the corner is what is commonly called a "blind intersection," that is, one at which cross traffic cannot be seen except at the meeting of the roads, absolute minimum speed is in order. If it is blind to a driver traveling thirty miles an hour, it may not be blind to one moving at fifteen.

Intersections are blinded by a variety of obstructions: by trees, hills, hedges, buildings, corn or wheat fields, tall grass or billboards. In some cities buildings are located very close to the street and every entrance to a cross street in such places is a blind intersection.

Motorists should be aware of seasonal variations in the

blindness of intersections. Traffic is accustomed to pass through a certain small Long Island town at a pace of thirty or thirty-five miles an hour. The land is flat and there are no trees; houses are set far back from the road and the street is wide. Approaching cross traffic can be seen for more than a hundred feet from intersections, and thus, under such conditions, the average speed is not excessive. During August, however, vegetation on vacant corner lots reaches a height great enough to interfere with the view of the intersecting roads. The change in conditions is unappreciated by many drivers, and as a result, there is a regular increase in accidents at that time.

STREET ILLUMINATION AT NIGHT—Although traffic at night is only one-fifth as heavy as during the day, more than half of all fatal automobile accidents happen at that time. According to illuminating engineers, this toll can be greatly reduced by adequate and proper lighting. A recent study of conditions in forty-two large cities revealed some interesting facts. One group of twenty-two cities increased its street lighting costs by eleven per cent and experienced a twenty-five per cent decrease in motor accident fatalities at night. The other group of twenty cities reduced its street lighting costs by fourteen per cent and suffered an eight per cent increase in fatalities.

MULTIPLE LANE HIGHWAYS—In recent years, many highways have been built large enough to accommodate as many as eight moving lanes of traffic. Three and four lane roads are commonest, however. On the three-lane road, the center lane is for passing only, and through traffic keeps to the right. Unfortunately, many drivers violate this rule, and some of them, insisting on riding down the center lane, have been responsible for head-on collisions and sudden death; in fact, three-lane highways have proved more dangerous than two-lane highways.

On four-lane roads, the outer strip nearest the side is for slow-moving cars, the inner for faster traffic. Here the good driver keeps to the right on the outer lane until he overtakes a slower car. Then, exercising due care, he moves on an oblique path to the inner lane, then out and around the slower car. Because all cars on multiple lane highways are usually moving at a steady, rapid pace, every care should be taken to warn other drivers, especially those in the rear, by proper hand signals of any necessity for moving from lane to lane.

On six-lane and eight-lane roads, movement across the center line is usually prohibited, and minimum and maximum speed limitations are rigidly enforced. Signs, signals and roadway markings plainly indicate the conditions peculiar to such highways. Highways with four or more lanes should, if possible, be divided in the middle by medial strips. The presence of such medial strips makes a highway far safer.

ONE-WAY STREETS—Traffic congestion and often the narrowness of the street itself have forced many cities to compel traffic to move in only one direction on various thoroughfares. Such "one-way" streets are plainly marked by arrows or other devices pointing the direction of traffic flow.

THROUGH AND STOP STREETS—The movement of traffic on express highways, main streets and boulevards is made safer and more efficient in many places by regulations compelling every driver approaching from a side street to bring his car to a complete stop before entering or crossing the main thoroughfare. The main road is called a "through street"; the side road a "stop street." Both are plainly marked by signs, and a good driver obeys them in order to help speed up traffic and avoid accidents. Somewhat the same situation maintains in

the country with regard to the intersection of through highways and minor crossroads. Even though there may be no signs, the car on the crossroad should defer to the traffic on the through highway.

SIGNS AND SIGNALS

To the good driver, signs and signals along the highway are as important as charts and compass to the modern mariner. Both tell the man at the wheel how to proceed with safety.

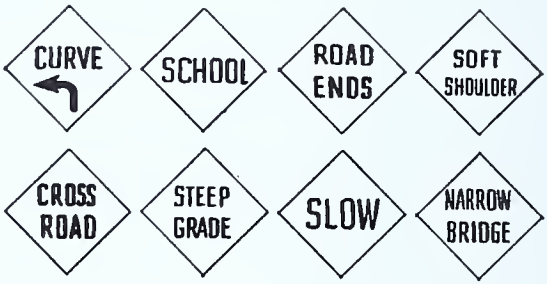
TRAFFIC LIGHTS—The commonest signal, and the one that is most important to the motorist, is the traffic light at intersections. Such a system of timed color flashes eliminates confusion and facilitates the safe flow of traffic at crossings. It should be used on important arteries and congested streets and wherever traffic conditions require.

Universally a red color means STOP and a green color GO. In two-color systems, there is usually an interval between the red light and the green light in which the light shows red in both directions. This interval is designed to allow traffic on the cross street to clear itself before the traffic flow changes.

In three-color systems, the yellow color is shown a few seconds between the green and the red (the light on the cross street remaining red). This yellow light serves both as a warning and as a directional signal. It warns the motorist that there is about to be a change in the flow of traffic; it directs him to slow down and stop, unless he is already so close to the intersection that a sudden stop would be dangerous, in which case he may cross if he does so cautiously. It informs the pedestrian that there is insufficient time to cross the roadway and that if he starts to cross at that time, he must yield the right of way to all vehicles.

SEMAPHORES—In some cities, semaphores are used instead of traffic lights.

BLINKER LIGHTS—Red or yellow blinker or flashing lights usually call attention to dangerous intersections, railroad tracks, sharp curves or steep hills. The good driver slows down on seeing them, and regulates his speed to suit the condition to which they call attention.



WARNING SIGNS—Various signs, such as *Curve Ahead; Steep Hill; Keep to Right; Narrow Bridge; Road Slippery When Wet; Soft Shoulder; Cross Road,* have been placed along the highway by engineers in an effort to assist the driver in avoiding dangerous situations, to help him "see ahead." A diamond-shaped sign is usually a warning to slow down, while a square indicates hazardous conditions and therefore the need of caution. Both should be placed a sufficient distance ahead of the hazard described to enable a good driver to meet it without mishap.

REFLECTORS—In order to be visible for night driving, many warning signs are equipped with reflector devices which illuminate the signs when they are struck by a beam from an approaching headlight.

OTHER SIGNS—Other signs along the highway tell the motorist of local traffic rules and regulations such as those governing speed, parking, one-way streets or pass-

ing procedure. Direction signs help the stranger to find the road he wants to take.

All good drivers have great respect for signs and know that they are invaluable aids to safe, comfortable driving. They know, too, that those who disobey signs are pitting snap judgment against the wisdom of trained engineers who have put years of work into study of the problem.

STREET MARKINGS—Center lines on the pavement divide streams of traffic moving in opposite directions. A solid painted line on hills and curves usually signifies that passing is unwise or prohibited. A broken white line is used as a guide to traffic and is particularly useful at night on black macadam roads. Lane markers are useful in certain places to keep motorists from wandering. Various markings at intersections, including signs painted on the pavement, are used for laning traffic.

ROUTE NUMBERS AND MAPS

All of the more important modern highways are numbered; they form part of a somewhat intricately planned but easily understood system of state and federal routes. Such routes are marked distinctively at frequent intervals by shields and other signs, the standard federal marker being a shield; the federal routes are the more important east-west and north-south interstate highways.

Transferred to maps, these route numbers make it easy for the motorist who is planning a long trip into unfamiliar country to select the shortest and best roads. By familiarizing himself with the route number system he can always be certain that he is on the right road, and he can

reach his destination without the inconvenience and discomfort of losing his way. For example, if he plans a trip from Denver, Colorado, to Los Angeles, California, he need not remember anything more complicated than the following: Take "U. S. 287" to Laramie, Wyoming; then, "U. S. 30" and "U. S. 30 S" to Echo City, Utah. There follow "Route 89" to Salt Lake City, and then "U. S. 91" to San Bernardino, California. Then take "U. S. 66" into Los Angeles.

What a contrast to the directions given in an old fashioned travel book: "Proceed East from the town of Schellsburg for a distance of 4.6 miles. Take right at fork of road at red school house on the right."

State highway departments, civic associations, automobile clubs, and oil companies prepare and distribute free road maps. These contain, beside route numbers, other pertinent information, such as the kind of road surface to be found. For example, a heavy black line may indicate hard-surfaced roads, a broken line a gravel road, and a dotted line a dirt road. Some such maps issued periodically report highways under repair or reconstruction and recommend best detours around them.

CHAPTER VII

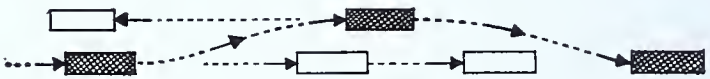
CODES OF THE ROAD

THE courtesies and customs of mankind make the world a more agreeable and a more civilized place in which to live. The secret of being a lady or a gentleman is not a facility in remembering and observing intricate formalities, but the possession of a genuine regard for the feelings and comfort of other people. This chivalry has an immediately practical effect also for it eases human relationships, whether it is exercised in such a minor matter as waiting in line to buy tickets for a moving picture or in driving an automobile on a crowded highway. In either case the civilized person is patient and considerate.

Consider what folly it would be if every man who appeared before a box office window to buy a theater ticket were to exercise his "right" to have a ticket first without waiting in line. In the inevitable struggle, the stronger would overcome the weaker, and few would be able to enjoy the entertainment they came to find. The parallel on the highway would be much the same except that such conduct would certainly leave a red trail of death and destruction appalling to imagine. The good driver is essentially a gentleman, appreciative of the necessity for establishing and respecting "codes of the road."

IMPORTANT CODES

KEEP TO THE RIGHT—Easily the most important of these codes in the United States is the law which compels all cars to keep to the right on two-way roads. The reason is obvious, for if two cars approaching each other from opposite directions did not automatically move to the right, what would they do? Would each driver stop and call out to the other what his intentions were? Would one car veer to the right, the other to the left in an inevitable head-on collision? In spite of the simplicity and evident good sense underlying the keep-to-the-right rule, thousands of drivers, most of them of the species "road-hog," violate it day in and day out. Needless to say, they cause accidents.



KEEP TO THE RIGHT . . . PASS TO THE LEFT

PASS TO THE LEFT—Another fundamental and universally understood code for good driving governs overtaking and passing other cars. The driver of the faster car on overtaking a slower one, blows his horn and then, when sufficient passing space is given, passes to the left. The driver of the slower car, on hearing the signal, moves to the right, in order to give as much room as possible for a safe passing manoeuver. In most places it is illegal to pass a car in any other manner.

TRAFFIC LAWS

Violation of road courtesies, the kind of conduct which makes self regulation impossible, is fundamentally the reason for traffic laws. An example of how the authority of law was forced to supplement road courtesy occurred recently on a four-lane highway which led over a draw-

bridge connecting two Eastern cities. When the draw was up, courtesy required all cars to form a double line at the right of the road, but when traffic was heavy a number of drivers would seize the opportunity to form a third line on both sides of the bridge. This procedure tangled up traffic completely when the draw came down, and in order to straighten the situation out, police were forced to lead the third line around in front of the cars already waiting in the customary two lines. Protests over the unfair advantage enjoyed by the discourteous became so great that a law was enacted prohibiting the formation of the third line.

WHAT FORM OF TRAFFIC REGULATION IS BEST?—There is a difference of opinion regarding the best form for traffic legislation. Many motorists and legislators feel that each bad driving practice should be specifically prohibited. Others maintain that a statute should state simply that it is illegal for a driver to act in a manner that is contrary to that of any prudent man in similar circumstances. According to the former group, the second procedure fails to give police officers a sufficient basis for effective enforcement, and makes the ordinary violator more difficult to convict. Most traffic codes are a compromise between these two schools of thought.

SPEED LAWS—Regulations governing speed provide a good illustration of the effect of this compromise. The advocates of specific laws recommend that maximum speeds be established for each locality, and in some cases, for each road. The second group asks that it be made unlawful for any driver to exceed a speed which a prudent driver would find unsafe for the specific circumstances. In general, the recommendations of the latter group are the basis for all speed laws although their ideas are supplemented by certain arbitrary limits—usually

nowadays: twenty miles an hour in business districts, twenty-five in residential sections and forty-five on the open highway. If a driver exceeds these limits, the burden of proof, in case of an accident, lies with him. That is, he is presumed to have violated the law unless he can prove that under the circumstances his speed was safe and reasonable, a difficult task in the face of the trained judgment of the arresting officer.

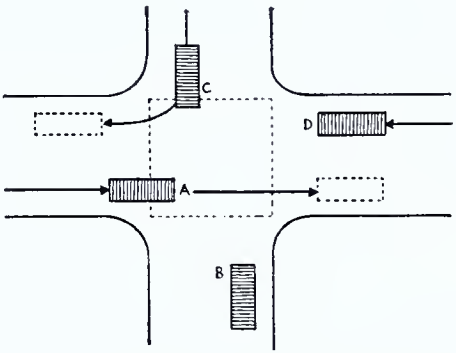
In Evanston, Illinois, recently, the driver of a heavy truck was arrested and convicted of speeding though he was admittedly traveling only seventeen miles an hour at the time of his arrest. Officers produced test records showing that his truck could not be stopped in less than fifty feet at that speed; in other words that his stopping distance at seventeen miles an hour was equal to that of the average car traveling thirty miles an hour. Under the circumstances his speed through a crowded business district was unsafe.

RIGHT OF WAY

Who has the right of way? No road courtesy appears to be more generally misunderstood by drivers and pedestrians alike, and real differences of opinion have found their way even into state laws. As far as the rule can be generalized, however, the guide used by courts in determining responsibility for accidents is: "The car on the right has the right of way *provided* it enters the intersection first; but if the car on the left appears first in the intersection, the car on the right must yield." A more intelligent way of controlling the situation would seem to be: "If it is clear that a car will enter the intersection first, then that car should be conceded the right of way, but in case of doubt the car on the right should be conceded the right of way."

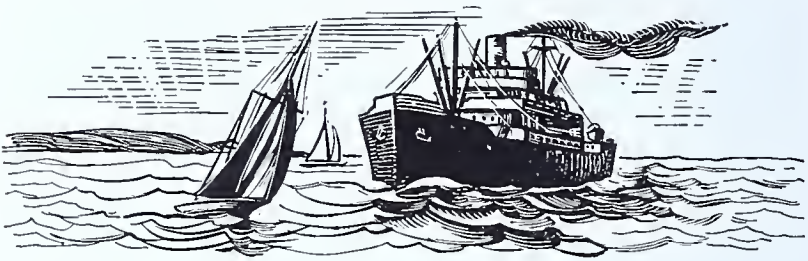
In addition, there are two general rules which admit

no exceptions: first, the pedestrian who is already in the intersection always has the right of way where intersections are unprotected by a traffic light; second, all vehicles must yield to emergency cars such as fire engines, police cars and ambulances.



In some places automobiles approaching intersections must give the right of way to other vehicles which are already in the intersection attempting to make a left turn. On through streets cars should as a matter of courtesy grant the right of way to vehicles coming out of stop streets provided the latter have complied with the full stop regulation. There are other rules peculiar to individual localities which every good driver learns and applies.

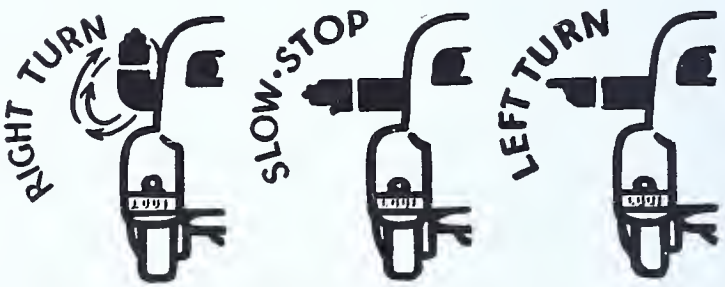
Right of way rules were developed first on the high seas where sailing ships moving on certain tacks found it more difficult to stop or alter their courses than those moving on other tacks. A code of sea courtesy prescribes easy procedure under all such circumstances as well as a system of signals which enables each helmsman to know what course the other will take. This code is ideally adapted to conditions on the water, where vessels are visible from a distance and moving at moderate speeds; it is rigorously obeyed by all sea-faring craft.



Unfortunately the same success has not been achieved on land with motor cars, and good drivers do not rely too strongly on the assumption that others will know and follow the rules. Good drivers not only obey the law themselves, but they avoid contests over the right of way. In fact, many trucking concerns hold their drivers responsible in any accident involving a dispute over right of way.

HAND SIGNALS

The use of proper hand signals is one of the ideal courtesies of good driving. They become necessary only when a driver plans to change his even pace straight ahead in



order to stop, slow down, turn right or left or enter another lane. Signal procedure differs somewhat in the various parts of the United States, but the signals described here are those that are most generally accepted and understood.

LEFT TURNS—Left turns are indicated by extending the left arm out of the window, and pointing the index finger in the direction to be taken. This signal should be used also when you move from the curb into a stream of traffic, or when on multiple lane highways you move from a right to a left lane to pass another car.

STOPS—The stop signal, which is used also as a slow down signal, is given by extending the left arm out of the open window, the palm of the hand being open and facing backward.

RIGHT TURNS—Right turns are indicated by extending the left arm out of the window and moving it in a rotary manner as though beckoning those in back to "come on!" This signal may also be used when you intend to slow down. Another signal for a right turn that is largely used in certain parts of the country is made by bending the left arm sharply upward. If this position is combined with a rotary motion of the arm, your intention will be understood everywhere.

SIGNALS SHOULD BE INSTINCTIVE—The signals that have been given here have the great advantage of being instinctive. In an emergency one might get confused in the use of signals that were artificial and arbitrary.

FALSE SIGNALS—Drivers should beware of pointing out the window to objects in the landscape and of flicking off the ashes of cigars or cigarettes for fear of having these motions interpreted as signals.

SIGNALLING IN BAD WEATHER—The hazards which require hand signals in clear weather are no less in bad weather; if anything, they are greater. However, the fact that the window next to the driver is often closed when it rains or snows or is intensely cold leads many drivers to ignore hand signals or to neglect them, realizing that by the time they could lower the window, the

immediate necessity for a hand signal might have passed. Extraordinary care in such cases must be made to take the place of a hand signal. By bringing his car to a slow, gradual stop or by carefully taking a position in the lane that is proper for the turn he desires to make, a driver may indicate with reasonable clearness what he usually conveys with hand signals. In addition, electric stop signals which light at the rear of a car when the brake is applied may serve as further warning.

THE HORN—Misuse of automobile horns has stimulated a strong movement to outlaw them entirely. In London, recently, the Minister of Safety banned their use within city limits, and New York City has undertaken a similar experiment in this country. The indiscriminate tooter of automobile horns is a pest and an annoyance to all. Properly used, a horn can serve several good purposes. First, it can be employed to warn the vehicle ahead that you wish to pass; second, it is a well-recognized warning to pedestrians and cyclists; third, it can be used to advantage on curves and hills, particularly on narrow country roads, in order to give drivers coming in the opposite direction advance notice of your presence.

The indiscriminate tooter attempts to make a horn serve a variety of other purposes: to urge other cars to speed up or slow down, to move to the right or left, to stop or yield the right of way. The same drivers toot their horns to indicate they are going to stop, go faster, make a turn or go straight ahead. Many of such drivers appear to think that the toot of a horn relieves them of whatever responsibility they may have for anything that happens. A motor vehicle commissioner once noticed a woman who used a horn in just such a manner, blowing it always for intersections either as she approached them, as she reached the middle of them, or just after she cleared them. He predicted that if ever she was involved in an accident she

would plead that she had blown her horn. Three weeks later the predicted accident happened. The woman gave the anticipated excuse: she had disobeyed a red light!

All things considered, there would probably be fewer traffic accidents if there were no horns, for too often the sounding of the horn is a demand for either a pedestrian or another motorist to get out of the way; sometimes this demand is not met. If there were no horns the motorist would have to depend upon his own action to avoid an accident, not the action of someone else, and this in general is a far safer and more reasonable procedure.

In large cities, motorists misuse horns chiefly to express their impatience with traffic delay. The senseless din hinders not only those who are trying to untangle traffic, but annoys workers and residents in nearby offices and homes.

THE PROBLEM OF HEAVY TRAFFIC

In heavy traffic three outstanding evidences of discourtesy contribute to difficulties and serve to obstruct the safe and rapid flow of automobiles. They are: (1) trying to beat the traffic control signals; (2) dawdling; (3) cutting in and weaving.

BEATING THE LIGHT—The worst of these is trying to beat the traffic light. One of the goals of traffic control is to achieve a maximum efficiency of traffic flow at intersections. Without cooperation on the part of drivers, this ideal can never be reached. Yet we invariably find chiselers—usually those who suffer from hurry mania—who try always to plunge past at least one intersection just after the light has turned red. When they do wait, they leap forward instantly, usually just before the green GO signal flashes on. Why? There is no reasonable answer, for nothing is easier or more sensible to obey than an electric traffic signal. It has been electrically timed by en-

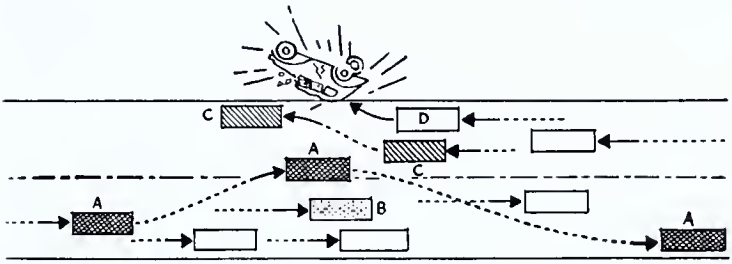
gineers who have given the intersection individual study, and barring complete breakdown can never operate in anything but an utterly fair and unprejudiced manner. Attempting to beat the traffic lights is the cause of many accidents.

HOW MUCH TIME CAN BE SAVED?—An interesting experiment to discover how much time is actually saved through the hurry mania by the practice of beating lights, and by other forms of ruthless driving, was conducted not long ago by the police department of a large Middle Western city. Two cars were started over a twelve-mile course. The driver of one car was instructed to obey scrupulously every rule of law and courtesy, to take his time about traffic lights, but not to dawdle. The other, an expert racing driver, was told to make his trip a mad dash, to beat lights, weave in and out of traffic lanes, pass street cars on the left, and generally to play all the insane tricks of the "hurry maniac." *The illegally driven car arrived at the end of the course only three minutes ahead of the carefully driven car!*

DAWDLING—Just as it is dangerous to drive faster, so it is often dangerous to drive slower than the average. Traveling too slowly for conditions, or dawdling, has become recognized not only as an annoyance and an inconvenience to other drivers but actually as a danger. In Massachusetts, for example, the Legislature in 1933 enacted a law requiring the driver of a slow vehicle to pull off the road as soon as a line of cars begins to form behind him. Drivers who wish to proceed slowly should keep far to the right, or avoid highways where the average speed is faster than they care to drive.

CUTTING IN AND WEAVING—Impatient drivers who attempt to pass when traffic conditions are unfavorable, usually are forced to resort to a deadly practice called

"cutting in." They dart out from a line of cars, pass one or two or three, and then, suddenly realizing that they must return quickly into line or collide head on with



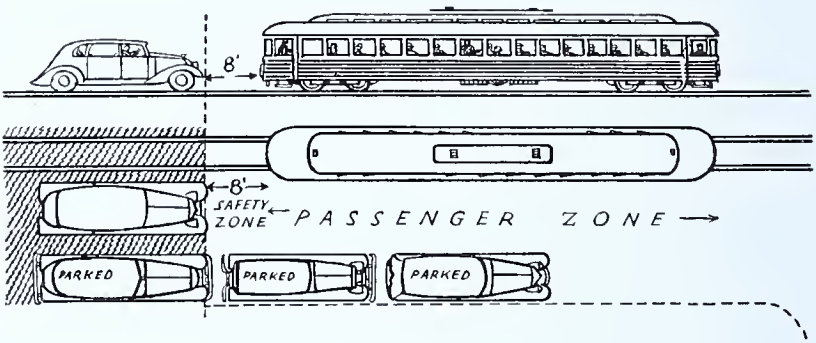
a car coming in the opposite direction, veer sharply back again. In order to make a place in the line for the cutter-in, an overtaken car must slow down. When it doesn't, and the offending car cuts in hurriedly anyway, the stage is set for a side-swipe. Weaving is a process whereby a driver, eager to reach the head of a line of traffic, passes other cars, now on the left, now on the right, wherever a small passing space appears to be available. According to accident records the practice is even worse than cutting in. Being in the proper lane and remaining there is one of the most important factors in good driving.

MISCELLANEOUS TRAFFIC REGULATIONS

OVERLOADING—When a car is overloaded, there are likely to be so many passengers on the driver's seat as to impede his visibility and hamper his movements in an emergency. The weight of the additional load places an extra burden on brakes, lowers their efficiency and increases the stopping distance required. In many places, overloading the driver's seat is against the law.

PASSING STREET CARS—Except on one-way streets, street cars should be passed only on the right. Like railroad trains, and for the same reason, namely, that they are

heavier, more difficult to stop and carry more passengers, street cars should be given the right of way. When they stop to discharge or take on passengers, an automobile should also stop a safe distance behind the open car door in order to give pedestrians a chance to leave the street car and reach the curb without dodging through traffic.



CATTLE CROSSINGS—If proper warning is given the automobile driver, cattle have the right of way in crossing from one side of the highway to the other. All along rural roads one sees signs marked "Cattle Crossing," and often in the early morning or twilight hours, one will find cows or other farm animals being driven across or along the roads between barn and pasture. Good drivers watch out for these locations, and exercise due courtesy and care.

HEADLIGHTS—In some states the practice of dimming the headlights as one approaches another car is a violation of the law. Here the same courtesy can be shown by depressing the headlight. Good drivers usually pay this courtesy to approaching cars and find that it helps to eliminate glare and to make meeting other cars a safer and more comfortable manoeuver.

MAKING WAY FOR EMERGENCY VEHICLES—When you hear the familiar siren or bell of a fire engine, a police car

or an ambulance, pull over to the right as far as you can, and slow down or stop until it passes safely. Because these vehicles are on emergency errands, often involving matters of life and death, they must travel as fast as possible, and therefore, they have a special right of way. Give this as you would want it given if they were coming to help you.

PARKING

Parked cars may be such a source of danger and inconvenience to other drivers that the rules of road courtesy are definite on how, when and where they may stand. In the first place, they reduce visibility, blotting out important signs and signals, and if parked too near corners, create blind intersections, as described in Chapter V. In most cities it is unlawful for cars to be parked so as to conceal stop signs, blinker lights, traffic lights or other control devices, and restrictive signs are posted to warn the motorist of these facts. In a New England town an improperly parked truck obscured a traffic signal and caused the driver of a light, two-door sedan to run through a red stop signal into another car. The driver of the other car, in turn, had not seen the first because the truck obscured his visibility, or he might have been able to avoid the crash.

IMPORTANCE OF VISIBILITY—Drivers should take care to park their cars on level ground where they can be plainly seen for reasonably good distances, especially at night. The good driver never lets his automobile stand on a curve or at the crest of a hill where restricted visibility may be the cause of an accident. At night, if street lights do not make his car visible for at least two hundred feet, he lights his parking lights and tail-light. On the open highway, the latter practice is followed without exception. In some states trucks carry flares which are used in case of breakdown. The flares are lighted and

placed a distance in front of and behind the truck so that oncoming drivers may see danger and steer around it.

INTERFERENCE WITH TRAFFIC—A parked car should not interfere with moving traffic, or decrease the usable width of the street or highway. On a rural road it is usually unlawful for a car to park on the traveled portion of the highway, and if a motorist needs to stop for a long period, he must pull off the road.

In cities and towns, the law usually requires that only one line of cars be formed along the curb. Many drivers attempt to form a second line parallel with the first in a bad practice called "double parking." Double parking is an inexcusable and dangerous practice, as is also the parking of a car at an angle when other cars are parked parallel to the curb.

PARKING TIME—In any town or city the amount of available curb space in business or shopping areas is limited, and parking presents a serious community problem. In an attempt to give all cars a fair share of the space, a system of time limits has been established for certain streets or sections of streets. These are plainly marked by signs which every right-minded motorist respects.

FIRE HYDRANTS—When fire breaks out every second counts. Therefore it is unlawful to park your car in front of a fire station house or within ten or fifteen feet of a fire hydrant. When communities spend thousands of dollars of the taxpayer's money for modern fire fighting equipment, they have a right to expect that it will be used to the best advantage. One unlawfully parked car may knock their careful plans into a cocked hat.

UNIFORM TRAFFIC LEGISLATION

We have been discussing codes of the road. As a matter of fact, there should properly be not "codes" of the road

but one code of the road. The effective range of the motor car is so great that it encourages traveling long distances on business and pleasure tours. The fact that traffic laws and road customs and courtesies are not uniform from state to state is a condition which is extremely confusing to the traveler. A simple practice permitted in his home town may be prohibited by law in one two hundred and fifty miles away. Unaware of this the traveler may suddenly find himself arrested and convicted, for ignorance of the law is no defense.

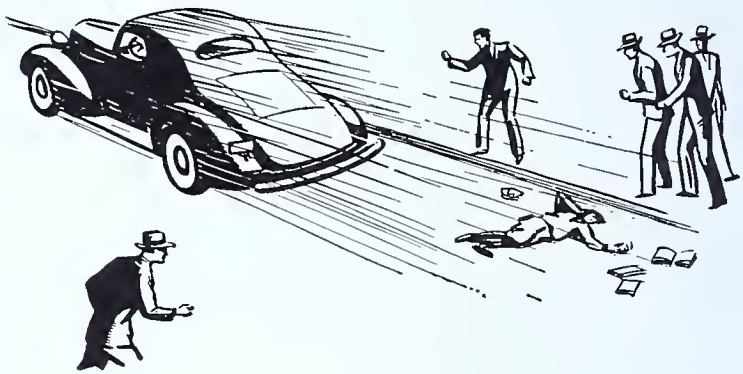
Because of this situation, there is a well recognized movement under way in the United States to bring about uniformity. It has the support of many outstanding organizations, particularly the National Conference on Street and Highway Safety, a semi-official body, under the sponsorship of the Bureau of Public Roads, which was organized for the express purpose of establishing a sound system of codes of the road on a uniform basis. Until such uniformity is secured, motorists traveling in strange territory must be on the lookout for differences in traffic regulations.

FIRST AID

The first duty of a driver involved in an accident is to render or summon first aid to the injured. This is a fundamental act of humanity expected of every human being, the more important because death may result if medical assistance is delayed. After attending to the injured, the driver must make his identity known to the other driver or pedestrian involved. In nearly all states he must file promptly a detailed report on the accident, regardless of whether or not it was serious. In some localities, he is required to summon the police so that they may conduct an official investigation.

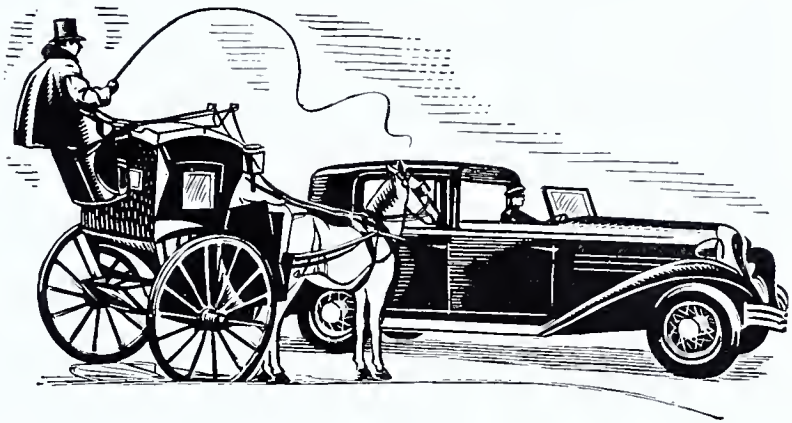
THE HIT AND RUN DRIVER—Nothing is more serious than the cowardly tactics of the hit-and-run driver who

flees the scene of an accident in the hope that he will escape possible punishment for violation of the law. Because his action deprives the injured of immediate medical attention and of the possibility of redress in the courts, the hit-and-run driver is treated with little mercy by the courts when the police finally catch up with him. The police, spurred on by the inhumanity of his conduct, often accomplish great feats of detective work in running down the hit-and-run driver, so that he does not often escape.



CHAPTER VIII

THE ART OF DRIVING



EVER since motor cars first appeared, an ever-widening circle of good drivers has been gradually forming to operate them. Good driving is an art, and like any other art or craft requires diligence, attention and practice to master. The members of this fraternity of good drivers are always to be looked for among that kind of people who in order to do anything at all must do it gracefully and well. These people are not organized in any formal society; they are not born to the purple,—they are self-made. Each qualifies by being able to satisfy his own conscience with a good driving record; he is constantly improving his skill just as he improves his ability at the piano, at hunting, at golf or tennis or swimming or a hundred other arts, sports and crafts—by practice and by study.

DRIVERS

After a comparatively short experience, almost any person can become capable of performing the ordinary tasks in the operation of an automobile. He remembers and observes the commoner rules and courtesies, and he avoids causing accidents, although he may be involved in a few which he considers were "not his fault." If, however, he fails to exert himself further, if he fails to acquire a broader knowledge and a greater excellence in the art of driving,—the kind that among other things would enable him to prevent mishaps which were not his fault,—he takes his place among the millions of just average drivers, neither good nor bad. Or he may actually slip backward and become a poor driver.

THE SPECTACULAR DRIVER—There is one particular type of poor driver that is peculiarly offensive, the spectacular driver; he attempts by making a show of himself to give the impression of good driving. There is all the difference in the world however between the good driver and the spectacular driver. Nowhere is this more evident than in the way each approaches a traffic light. The spectacular driver dashes up to the intersection at full speed, jams on his brakes, and brings his car to a noisy, jarring stop. The good driver cuts down his speed slowly and gradually long before he comes to the crossing so that, by the time he arrives, a slight, even pressure on the brake will stop his car quietly and smoothly without discomfort either to himself or his passengers. The spectacular driver tries to make the simplest act appear showy and difficult, while the good driver attempts to make the most difficult act seem easy and effortless. The good driver is in a class with champions; his showmanship lies in grace and simplicity. In this and the succeeding two chapters we propose to discuss certain skills which make the good

driver, and, by comparison, those qualities which characterize the poor one.

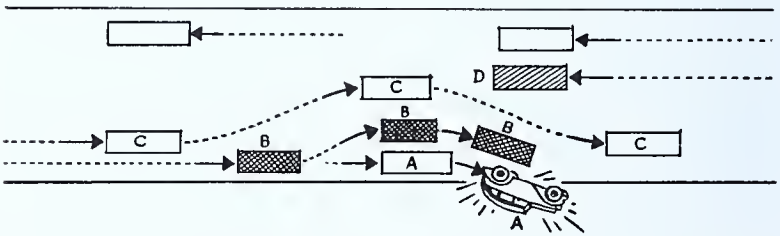
FACTORS OF SAFETY—Perhaps the outstanding characteristic of the good driver is one which underlies all his other skills, his application of what is technically known as the "factor of safety." In designing buildings, bridges and other structures, engineers draw their plans so that the completed structure will endure a load many times greater than any which could ever be placed upon it. For example, the George Washington Bridge over the Hudson River is strong enough to bear up eight times as many automobiles as could possibly be driven upon it. "The factor of safety" is the measure of this extra strength.

The spectacular driver invariably ignores this important principle, and continually exposes himself to situations from which he can escape, if at all, only by breathtaking feats of quick thinking or lucky action. Giving himself no margin, he drives faster than necessary, stops suddenly, makes sharp turns literally on two wheels, and misses colliding with pedestrians, other cars and stationary objects only by inches. Eventually, the law of averages challenges him with a situation which his limited abilities are unable to meet, and then the curtain falls on his career.

The good driver, on the other hand, provides himself with a large and comfortable factor of safety, and rarely creates or encounters a critical situation which draws heavily upon his skill. If he does, he has plenty in reserve.

POOR DRIVERS CAUSE ACCIDENTS—The spectacular driver frequently squeezes out of tight spots, but when he does he is often guilty of forcing other drivers into bad accidents even though he may escape himself. On the road between South Bend and Chicago not long ago, a small coupe was attempting to pass a sedan on the correct

lane of a four-lane highway. Up sped a spectacular driver from the rear of both cars, and decided to go around the coupe far over to the left on the forbidden part of the highway. As he came abreast of the cars, he saw two other cars bearing down on him at high speed from the opposite direction. To escape a head-on collision, he swerved in front of the coupe. The coupe veered to the



right, side swiping and overturning the sedan, but the spectacular driver, unscathed but guilty as a thief, rode on, not daring even to look back.

SPECTACULAR DRIVERS DESTROY THEIR OWN CARS—Examine a car after it has been driven 10,000 miles, and you will discover what kind of driver has been operating it. The spectacular driver's car is usually in dire need of repairs because his kind of driving has strained motor and brakes, ruined the delicate mechanisms of clutch and transmission, and branded the marks of many a narrow escape on fenders, bumpers and paint. The good driver's car is in a condition almost like new; the motor runs smoothly, the brakes take hold perfectly, there are no bruises and scratches on the body.

CHARACTERISTICS OF THE GOOD DRIVER—Like all skillful people, the good driver has a capacity for detail, and the ability to execute it easily and quickly and at the proper time. He is equipped with good driving habits and prepared decisions (See Chapter IV), and knows what to do in a critical situation long before the need to

employ his knowledge arises. He is observant, profits by his own mistakes (never repeats the same one), and learns from the mistakes of others. By observation he knows, for example, that the front and rear ends of a street car swing wide, and in consequence, he gives them a wide berth. A thin trail of smoke from the exhaust of a parked car far down the road means a very definite thing to him. What? That the engine of the car is running, and that the car may pull out into the stream of traffic at any moment, possibly without warning. Whether its driver signals or not, the good driver is forewarned and ready to give the other car plenty of room. Do you see the resemblance between the good driver and the skilled woodsman? Each has an ability to guide himself by subtle signs and evidences which escape the less competent.

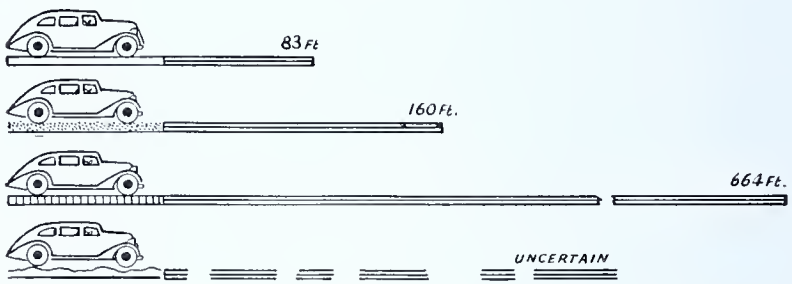
CONTROL OF SPEED

In his control of speed the good driver demonstrates his mastery of the art of driving, bringing into play all his knowledge of motor mechanism, reaction time and stopping distances, traffic rules and courtesies, and with these, observation and good judgment. Proper speed depends

upon conditions on the highway, and any speed either too fast or too slow may have serious results. As we have already explained, a moving car has a long nose which grows longer and longer the faster it goes. A car traveling thirty miles an hour has a nose eighty-three feet long (stopping distance fifty feet plus reaction time thirty-three feet) and, therefore, occupies a solid space on the

highway eighty-three feet long! At sixty miles an hour, the stopping distance is not twice, but four times as great.

ROAD CONDITIONS AND THEIR EFFECT—The figures given above represent ideal conditions—good brakes, average reaction time, and a dry, level, hard road with a rough surface. Conditions and, therefore, stopping distances vary, for while brakes slow the wheels down, they do not necessarily stop the forward movement of the car unless there is an effective degree of friction between the tires and the road. In consequence, in wet or icy weather, on the downgrade, or on loose gravel, dirt, bumpy or smooth-surfaced roads where friction is decreased braking distance increases. On a gravel road, for example, nearly twice as much braking distance is required, and on a sur-



face of wet, creosoted wooden blocks *nearly eight times as much!* A bumpy road throws the wheels into the air part of the time and during this time there is no friction.

ASSURED CLEAR DISTANCE AHEAD—Besides knowing how long his car's nose is at various speeds on different kinds of road surface, the good driver mixes another important ingredient in his determination of proper speeds—a judgment factor which involves the question of "assured clear distance ahead."

"Assured clear distance ahead" means the distance ahead which you can definitely depend upon having for

stopping if necessary. So far as hills and curves are concerned this distance is, in general, the distance ahead that you can see the road, and in such cases this distance should be the stopping distance, taking both reaction time and braking time into account. If for instance you are traveling at a speed of thirty miles an hour you must have an assured clear distance ahead in rounding a curve or going over the top of a hill of eighty-three feet. If you do not have this, you are taking a chance for you may find a stalled car or a herd of cattle just around the curve or a car coming out from a side road just over the top of the hill.

ESTIMATING VISIBILITY—Distances and visibility are estimated quickly, accurately and almost automatically by good drivers, and these estimates become additional factors in determining proper speeds. Curves, hilltops, and intersections all require reductions in speed to the degree that they obscure visibility. At intersections, the good driver estimates the speed and distance of other cars, notes whether the crossing falls into the "blind" class, observes the parked cars or other stationary objects near it which may hide a pedestrian about to step into the car's path. With all these in mind, the good driver adjusts his speed so as to be able to make a quick emergency stop if he needs to do so.

ESTIMATING SPEED—As a glance at the speedometer will show, we often go faster than we mean to in our smooth-running and comfortable modern cars. The changing quality and width of roads play havoc with whatever natural abilities we may have at guessing how fast we travel. We cannot wholly depend for our judgment on the rapidity with which trees and telegraph poles pass the windows of our cars. In city traffic twenty miles an hour may seem faster than thirty-five in the country, because

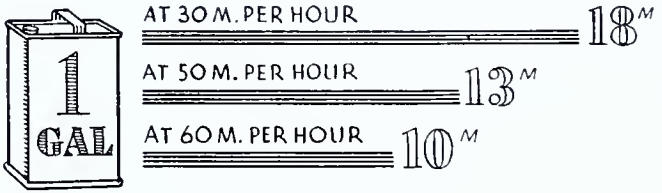
both moving and stationary objects are closer and seem to be traveling by with greater speed.

A dangerous illusion is the feeling of going slowly. For example, after driving forty-five miles an hour if you suddenly reduce speed to thirty, the change makes you think your car is crawling. *It is crawling at the rate of forty-four feet per second!* Thus, entering towns or residential districts from the open highway, the good driver recognizes the possibility of a lapse in his judgment of speed, and consults his speedometer. Many accidents on curves come from drivers, even average drivers, underestimating speeds in the modern car.

DISTANCES BETWEEN MOVING VEHICLES—On the open highway where cars are traveling at a fairly rapid pace, an estimate of the distance between moving vehicles becomes an important part of driving judgment. In following behind other cars the assured clear distance ahead should also ideally be your stopping distance because the car ahead may get into a collision or have other trouble that will bring it to a sudden stop. Certainly in fast driving one cannot afford to have an assured clear distance ahead that is materially less than the stopping distance, for the possibilities of a very serious accident are otherwise too great. It is a fact, however, in a line of traffic traveling at moderate speeds that a distance between cars equal to the stopping distance will not be maintained; this means in effect that the driver is counting on the car in front of him not having to make an emergency stop. If you are driving in such a line of traffic and maintain a distance from the car in front of you equal to your stopping distance, you may find that cars behind will continually pass you and cut in. The problem is a vexing one and one which state authorities should have a hand in solving. Perhaps as good a solution as possible if you are in such a line of traffic is to leave a distance between your car and

the next car in front of you a little greater than the average and be constantly on the alert for an emergency stop.

SPEED AND ECONOMY—Constant driving at high speeds uses more gasoline for the same distance covered and exerts a greater strain on tires and brakes than more moderate speeds. The tires on Sir Malcolm Campbell's racing machines are so badly frayed after one test run that a complete replacement is required despite the fact that the strongest available tires are used. A speed of from twenty to thirty miles an hour is the most economical for gas and tires. A light car, for example, will go eighteen miles on a gallon of gasoline at thirty miles an hour, only a little more than thirteen at fifty, and less than ten at sixty. The air resistance for instance varies at a rate somewhere near the cube of the speed, that is, if you double your speed you increase the air resistance about eight times.



BLOWOUTS—Excessive speed always increases the danger of blowouts and increases the severity of the possible disaster. The faster a car goes, the hotter the air in the tire tubes becomes; this causes expansion and softening of the rubber. In addition, the impact of tires against sharp objects in the road is correspondingly greater so that a worn tire which might last hundreds of miles at a slower speed may burst at sixty miles an hour.

Even at low speeds a blowout is an unpleasant experience, for the burst tire acts as an anchor forcing the car to swing around and lurch from side to side. The good

driver, caught in such an emergency, may recover from it in much the same way as he tries to recover from a skid, for the effect is almost the same. He steers in the direction of the sideways motion—*if road conditions permit*—and he avoids braking or throwing out the clutch until his momentum is under control. At high speeds a blowout is exceedingly dangerous not merely because the car may leave the road but because it may collide with approaching cars.

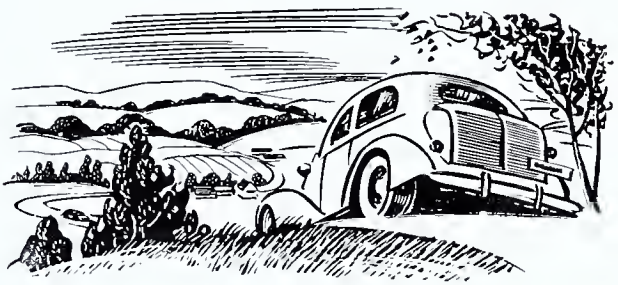
SPEED IN STREETS WHERE CHILDREN PLAY—Regardless of the fact that children are repeatedly told about the danger of playing in the street, many of them forget such warnings in the excitement of play. The driver, therefore, is always and inescapably responsible for their safety. One of a group of children may dash into the street to recover a ball and find himself in the path of a moving car. All good drivers sense their responsibility toward children, and are constantly alert to this hazard in residential districts or other places where youngsters play.

BRAKE WEAR—One of the fundamental laws of physics is that energy cannot be destroyed; it is only converted into another form. What happens then when brakes stop a car and the energy of motion disappears? It disappears in the form of heat; heat is the new energy that is developed by friction between brake linings and brake drums, and it sometimes reaches a temperature of 1400 degrees. Such heat not only destroys brake linings but even damages brake drums. Engineers have said that after three emergency stops from a speed of sixty miles an hour, most brakes require a complete readjustment or even re-lining.

EMERGENCY REQUIREMENTS—The good driver is careful not to strain his brakes in routine driving; he saves

them for emergencies. Wherever he can do so, particularly on hills, he uses the compression of his engine as an aid in stopping his car, and when he approaches a stopping point he drives at slower speeds. He also keeps all his tires in good condition so there will be no inequalities in the sureness with which all four tires grip the road.

DESCENDING STEEP HILLS—On the downgrade of a long, steep hill second or low gear is the best "brake" for keeping a car under control and for saving brake linings and drums. If the brakes themselves are used, friction will



accumulate enough heat to do serious damage. A hill that requires the use of second or first gear in ascending should correspondingly require the same gear for braking purposes in descending. On shorter hills or on level ground, a trick known as "snubbing" may avoid part of the constant damage caused by heat. Snubbing the brake means slowing the car by a series of hard pressures on the brake pedal instead of a continuous, firm pressure. Between each of these hard kicks the driver wholly releases the brake, permitting the accumulated heat to pass off.

USING SECOND GEAR—Second gear has other important uses besides enabling the car to gather momentum when starting. The car is under more sensitive and effective speed control when in second gear, and this makes second

gear particularly valuable when driving in congested, slow-moving traffic, and especially at curves and intersections. Good drivers shift into second gear at corners where traffic conditions have forced them to go very slowly. The use of second gear on steep hills not only makes climbing easier but helps to keep the radiator from boiling, for the increased speed of the engine produces an increased speed of water circulation in the cooling system and an increased speed in the fan.

BACKING—One of the refinements of good driving is being able to back a car skillfully. Visibility is always restricted whether the driver uses a rear vision mirror, looks out the back window or pokes his head out the side. He must develop an ability to compensate for these deficiencies. By backing out of a driveway, for instance, he may interfere with pedestrians or other traffic, and so, if at all possible, he turns around and drives out head first. In traffic he finds it easier and often quicker to go around the block rather than attempt to back around on a main thoroughfare. In any case the lowest possible speeds and the highest possible alertness are required when backing.

CHAPTER IX

THE ART OF DRIVING—DRIVING UNDER SPECIAL CONDITIONS

Some years ago any description of the art of driving under the special conditions that are encountered in adverse weather might have been a labor of love. From early November to late May motor cars hibernated in closed garages, propped up on wooden blocks. During the summer months, when it rained, drivers found other things to do besides operating their cars—open touring cars for the most part—and only a hardy few ventured forth at night under any circumstances. Today, however, comfort has been built so successfully into our automobiles, that the conditions produced by bad weather, hot, cold or wet, are all but ignored. We drive under all kinds of conditions. In order to surmount these conditions we must, however, acquire and employ a special brand of driving ability.

NIGHT DRIVING

The need for an extra skill in driving at night and in the early evening is sharply and tragically emphasized by accident records. It has been shown by careful studies, though traffic is only one-fifth as heavy during the hours

of darkness as during those of daylight, that more than half of those killed in motor accidents meet death after sundown. Mishaps reach a peak between five and nine o'clock in the evening when drivers are hurrying home fatigued from a day's work. Perhaps most of these tragedies are the result of a common error that drivers make in failing to realize how greatly visibility is cut down at night and in assuming that the operation of a car at night requires no greater attention than during the day. Many of them are caused, too, by the fact that the roads over which the driver must travel are inadequately illuminated by artificial means.

CARS ON THE ROAD—In spite of the fact that there are fewer cars and pedestrians on the road at night, the good driver pays extra attention to traffic. It is a new kind of traffic, a traffic that moves as though each car were out alone in the world. Pedestrians are swallowed up in darkness and shadow, and may not be seen, if at all, until they are within a few feet of the car. Drunken drivers or those who have been drinking are more apt to be on the road after dark than during the day. In this new kind of traffic, while caution is inclined to go to sleep, the good driver should in reality be more alert than ever.

LIGHT PROBLEMS

During the day visibility may be limited by hills, curves, other cars or large objects in or along the road, but at night a whole basketful of additional difficulties in securing clear vision is imposed upon the driver.

HEADLIGHT LIMITATIONS—In the first place a driver cannot see beyond the limits of his headlights unless the highway is brilliantly illuminated by lights along the road. Let us say that the beam from his headlights illuminates the road 150 feet ahead. If he moves at forty miles an hour, his total stopping distance is about 132 feet; therefore, it is unsafe for him to travel any faster at any time, or he runs the serious risk of "outdriving the distance he can see ahead." At fifty miles an hour, his stopping distance is more than 200 feet. When a car rounds a curve, the headlights point diagonally across the road; this leaves the far end of the curve in total darkness, and reduces visibility often to less than fifty feet. Low speeds are obviously called for at night.

GLARE AND ITS EFFECTS—One of the outstanding causes for poor visibility at night is the blinding effect of glare from approaching headlights. This temporary but dan-

gerous blindness is caused by a delicate, protective mechanism which guards the eye from the entrance of too much light. Behind the pupil of the eye is a lens which focuses light on the retina. When the light is dim the pupil widens to permit more light to enter and when the light is bright the pupil contracts. The pupil contracts, however, much more readily than it opens, since it is more important to keep an intense light out, which would injure the retina, than it is to let a dim light in. This slowness of the pupil in widening is in evidence on entering a darkened movie theatre. For a few moments nothing can be seen except the screen; it is only gradually that you begin to see people and other objects as your eyes become adjusted to the darkness.

This phenomenon is important in the case of drivers, for the pupils of the eye contract rapidly when dazzled by the glare of oncoming headlights, and after the glare has passed they take their time about widening again; sometimes it takes a minute or more for them to become normal. During this time the driver is partially blind for driving purposes. If he is driving thirty miles an hour and it takes a minute for him to regain proper sight, *he will have traveled half a mile before the blindness passes!*

You can examine this action of the pupil by conducting a simple experiment. Set up a mirror, and arrange two sources of light, one dim and the other bright. Fix your gaze on the mirror and switch on the dim light. When your eyes become accustomed to this, without moving, switch on the bright light suddenly, and watch the rapidity with which the pupils contract. If you then turn off the bright light, you can time the speed with which the pupils expand to a normal seeing effectiveness in the dim light again.

AVOIDING GLARE—The glare from headlights can be considerably lessened with proper attention. The headlights should be adjusted for one thing so that the beam strikes below the eye-level of approaching drivers (see Chapter XI) and bulbs of not too high candlepower should be used. State laws require certain headlight adjustments, and frequent inspections will be needed to maintain these standards.

As already stated in Chapter VII, road courtesy requires that drivers whose cars are equipped with depressed beam devices use them when approaching other cars at night. These devices are usually controlled from the dashboard, steering wheel or from a floor pedal and require no great effort to employ. They lower the point of brilliance so that the full impact of glare from the headlight beam does not strike the other driver's eyes.

"ONE-EYED" DRIVERS— In violation of state laws cars sometimes appear on the highway after dark with only one headlight lit. It is impossible for other motorists to know whether it is the right or the left one that is out until they are almost abreast of the offending car. Serious miscalculations in the proper room to allow for a safe passage may occur as a result. Good drivers carry spare bulbs so that if one or two burn out they may replace them and keep their headlights in proper condition.

DODGING GLARE—The good driver has only one defense against motorists who ignorantly or discourteously fail to use depressed beams as they pass, or who drive with improperly adjusted headlights. He reduces speed and concentrates his gaze on the right-hand edge of the road, dodging the full brilliance of the oncoming lights as much as possible. Reduced speed also is necessary in order to avoid pedestrians or objects that may not be seen on account of the blindness produced by the glare.

GETTING MAXIMUM VISIBILITY—You can see best at night, as we have explained, when the pupils of your eyes are open widest. The less the light that strikes the eye, the wider the pupil opens. Therefore, it is best to make the seating compartment of your car as dark as possible, —even by turning off the dashboard lights when you don't actually need them.

DIFFICULTIES WHEN THE SUN IS LOW—In the early morning or late evening when a driver is moving in an easterly or westerly direction respectively, the sun may produce a glare similar to that of headlights. Furthermore the long shadows that are produced at this time tend to conceal objects, and alternating patches of light and shade distort even the best judgment of distances. Under such conditions cars equipped with sun visors may use them to advantage. The best compensation for difficulties such as these is, however, lowered speed. During twilight full headlight strength may not be needed to see ahead, but the good driver turns on parking and tail lights in order to make his car readily visible to others.

OTHER CONDITIONS

FOG—Fog is a subtle menace to all kinds of transportation. Trains reduce speed, steamers and sailing ships proceed with great caution, and airplanes are grounded. Good drivers use their cars as little as possible, realizing that fog not only destroys visibility but covers the road with a lubricating layer of moisture, and therefore increases stopping distances.

USE DEPRESSED HEADLIGHT BEAM DURING FOG—Light is reflected by the minute drops of water in a fog. If ordinary headlight beams are used a shimmering curtain of white is suspended before the driver, and he cannot see. Use of the depressed headlight beam will cause much of the light to be reflected downward.

DUST STORMS—Dust storms present similar, but even worse problems than fog. In a heavy storm driving is impossible not only because of poor visibility, but because minute particles of dirt are likely to clog the gasoline feed line and the water-cooling system, often causing serious damage. The driving force of dirt may even act like sandpaper on the windshield, impairing its transparency. As the air gradually clears, driving becomes possible, but the same caution with regard to headlights and braking distances should be taken as with fog. Dust as well as fog reflects light, and dust on the highway decreases friction between tires and the road surface.

RAIN—Rain may be easier to see through than fog, dust or darkness, but the fact that it spatters the windshield makes visibility under such conditions even more difficult for the driver. Mechanical windshield wipers—one on the left directly in front of the driver's line of vision, and one on the right—help keep a cleared space for seeing. But such visibility is by no means equal to the long-range visibility possible through a dry windshield, and therefore, the presence of rain demands extra alertness and reduced speeds. In fact the large areas not cleared by

the windshield wiper create a kind of temporary "tunnel" vision for the driver.

SKIDDING—Wet pavement naturally increases the hazard of skidding, but the danger is most prevalent immediately after the rain begins to fall. Whatever dirt is on the road mixes with the raindrops to form a slippery mud-paste which all but destroys friction between the tires and the road. After this is washed away, conditions become much safer unless an unbroken sheet of water forms over the highway. However, wet pavements in any case greatly increase stopping distances.

WET LEAVES—Perhaps the worst trap for the unwary motorist is a deposit of wet leaves on the roadway. As slippery as the celebrated banana peel, they cause skids not only during a rainstorm but for a long time afterwards because of their slowness in drying out.

WET CAR TRACKS—Good drivers avoid car tracks during rainy weather for they know that wet steel is more slippery than wet road. Even if only one wheel moves on a track, it may slide and throw the whole car into a bad skid. When they cross tracks, good drivers do so at an angle that is as near to a right angle as possible, cutting down their speed and avoiding the use of second or low gear until safely over.

WET SHOULDERS—During a rain dirt shoulders at the side of the road usually soften or turn into mud. Good drivers keep clear of them in order to avoid skidding or a possible turn-over, the former being much more difficult to control on a shoulder than in any other place. If a driver attempts to steer in the direction of the sideways motion he may force his car farther and farther off the road. Another hazard that may be developed by a hard rain storm is the washing away of part of the shoulder next to the road, thus forming a kind of curb. If this curb catches the wheels, the car may skid or overturn. In driving back onto the road, the best procedure is to slow down and return at an angle.

WINTER DRIVING

The conditions for winter driving are probably the most difficult "special conditions" of all, for they combine the worst features of fog, rain, poor visibility and increased stopping distances.

STARTING IN COLD WEATHER—Usually the first difficulty encountered by the driver in cold weather is a balky motor with a pronounced tendency not merely to stall but not even to start. Gasoline vaporizes less easily, oil in the engine and grease in the transmission are stiffened by the cold, and batteries, because of the greater demand upon them, may have a low charge or even be frozen. The good driver is not overwhelmed by these difficulties, however, for there are satisfactory ways of overcoming them. In the first place by disengaging the clutch when starting, he spares his engine the burden of turning the transmission gears through stiff grease. He pulls out the choke and allows the starter motor to turn the engine over a few times before switching on the ignition. This allows the engine to suck in a charge heavily laden with gasoline which fires more easily when the ignition is turned on.

Then, before starting his car to move, the good driver warms the engine by allowing it to idle a few minutes. *He never races the motor.* Why? The reason for warming the engine in the first place is to increase the lubricating efficiency of the oil because with cold oil the friction is greater. If the engine is raced, the pistons move up and down very fast in the poorly lubricated cylinders. The resultant friction is so damaging that the practice of racing may eventually necessitate expensive repairs. Many good engines have been destroyed by motorists whose impatience led them to believe that racing the engine was a good way of warming it up faster.

ICE ON THE WINDSHIELD—When the first snow or sleet strikes a windshield it melts in the general warmth of the car. Gradually, however, the cold outside air turns it

into ice and makes a base for additional snow and sleet to freeze on. The result is impaired transparency for the windshield and reduced visibility for the driver unless heating devices are employed to keep the ice from forming.

ICE ON THE ROAD—In spite of efforts to keep modern roads clear, the presence of ice continues to be the most

dangerous winter driving hazard, and good drivers must employ many skills in overcoming it. Two kinds of ice, rough ice and glare ice, are encountered. Glare ice is the worse as it is frozen into a smooth sheet from rain, sleet, mist, frost or melted snow. Rough ice is formed out of packed snow. The effect of ice on stopping distances is emphatic. An actual test made with a car that had been brought to a stop from twenty miles an hour in twenty-two feet on dry surface, showed that *on glare ice the best possible braking distance was 148 feet.* On rough ice, the best distance was eighty feet without chains, and forty-eight feet with chains. Chains are important helps to motorists who must drive in winter. Attached to all four wheels they improve braking and steering alike. Nevertheless, slow speeds are necessary throughout the winter, and under certain conditions, such as glare ice, chains are almost useless.

SKIDDING ON ICE—On slippery surfaces there is a tendency for wheels to "lock" when the brake is applied. Ordinarily, because of friction between tires and dry road surfaces, the brakes slow the wheels down but do not halt them completely until the force of friction overbalances the force of momentum. If the brakes are suddenly applied when a car is moving over ice, they may stop or "lock" the wheels completely while the car itself continues to slide on like a sled. Under such conditions it is no more possible for a driver to control direction than it would be if his car were mounted on four medicine balls.

HOW TO STOP ON SLIPPERY ROADS—Good drivers are unanimous in agreeing that slowing the car down gradually several hundred feet before a stop is actually to be made is the best way to avoid trouble on slippery roads. As the car is slowing up or "decelerating" a series of light pressures is made on the brake. The pressure is re-

leased immediately if the car gives any indication of skidding, and in the meantime the clutch is left engaged until the car is almost at a halt. The same procedure is used on approaching curves where the possibility of skidding is equally great.

STARTING A CAR ON ICE—There is a trick that can be used to start a car on ice which under other conditions would be considered a driving error. It is a common sight to see a car sway this way and that as its back wheels spin round and round when a driver tries to get moving in the usual way by means of the low gear. The trick on ice is to start in high gear by engaging the clutch with all possible care and slowness and through the use of this gentler gear to maintain the light friction that exists between the tires and the ice. If low or second gears are used, their greater driving force gives the wheels a sudden kick that starts them spinning. In fact, good drivers use these gears as little as possible on ice. The same method of starting can be used on other surfaces that are slippery because of rain, mud or wet clay.

CHAPTER X

THE ART OF DRIVING—DRIVING IN TRAFFIC

AN eloquent story of the art of driving as practiced by good drivers comes from the testing grounds of a large automobile corporation. Here cars are driven at high speeds under a wide variety of hazardous conditions, but *in fifty million miles of operation only one fatality has occurred.* That one was the result of a blowout as a test car sped ninety miles an hour around a curve, a condition that in this case need not be charged to the driver. The drivers employed for the tests achieved this nearly perfect record by obeying every rule of good driving.

While the average driver can usually avoid collisions with other average drivers, he cannot prevent accidents if he becomes confused by the wild actions of a poor

driver. In other words, he can *avoid,* but he is unable to *prevent* an accident. On the other hand, the good driver, our supreme practitioner in the art of driving, can in most cases prevent even such accidents; he has developed such cleverness that he can avoid being involved in mishaps with incompetent drivers or foolish pedestrians. In order to accomplish this he avoids creating or being lured into situations where his safety depends on the ability of the other driver. This philosophy of action will avoid ninety-nine out of a hundred accident possibilities. Some details of this procedure will be shown later in this chapter.

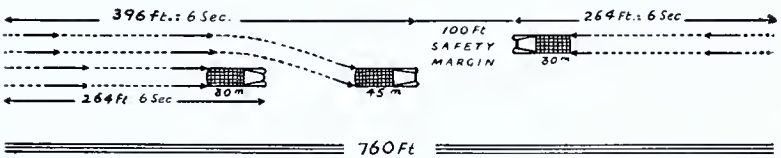
PROBABILITY

Poor and "just average" drivers are often led astray by the fact that they can disregard a good driving principle now and then without unfortunate results. Frequently, they assume that this violation which did not produce bad results in a particular instance proves the principle wrong and therefore worthless. Let us say, for example, that a driver on the average can ignore a stop sign ninety-nine times with complete impunity, but that on the hundredth time he has an accident. The probability, then, is one accident in a hundred, and if one hundred drivers each violated the principle once, one is due on the average to have a mishap. Which will it be? No one knows. Because the law of averages or probabilities is at work night and day, hour after hour, you can never predict whether your accident will occur the first, the forty-ninth, the one-hundredth or the three-hundredth time you take a chance, but at some time it will almost certainly occur. The most sensible procedure, then, is to observe the code of good practice all the time, one hundred times out of one hundred, for there is nothing in the theory of probability that is better established than the fact that even

a highly improbable event will at last happen if chances are taken enough times.

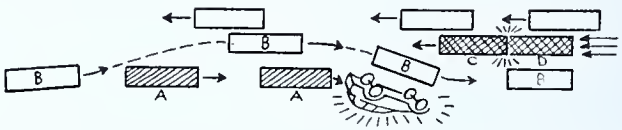
PASSING OTHER CARS

The poor and the just average driver are frequently unaware of the distances consumed in overtaking and passing another car. To give a specific illustration of the actual space needed, let us say that a car moving forty-five miles an hour is about to overtake and pass another going thirty miles an hour. The difference in speed is fifteen miles an hour. On the average it takes the faster car six seconds to overtake and pass the slower one. At forty-five miles an hour, the faster car travels 396 feet in six seconds. If a car traveling thirty miles an hour were to appear from the opposite direction, it would cover 264 feet in six seconds. Allowing only one hundred feet as a margin of safety, it would then be necessary for the passing car and the car coming from the opposite direction to be at least 760 feet apart when the passing manoeuver was begun. (See diagram below.)



HAZARDS OF PASSING—Failure to understand or apply these facts creates serious hazards and leads directly to thousands of frightful and gruesome accidents. For example, if a driver misjudges the distance necessary for passing, he may suddenly find himself on the left abreast of the car he has overtaken with another car only a few feet away coming directly at him from the other direction. His only escape is to veer sharply to the right, but this involves jamming in ahead of the overtaken vehicle.

Then two serious results are likely. First, the driver of the overtaken car sees a car cutting in sharply in front of him, and to avoid a side-swipe he must either make an emergency stop or often drive deliberately off the road. Second, the driver of the car coming from the opposite direction, to avoid a head-on collision, must also swerve sharply to the right, make an emergency stop and possibly drive off the road. In addition, if there are long lines of cars on both sides of the highway, the emergency stops create serious possibilities for rear-end collisions.



(See diagram above.) The chain of ugly circumstances that may be set in motion by such an error in judgment demands that the rules of passing be obeyed without deviation.

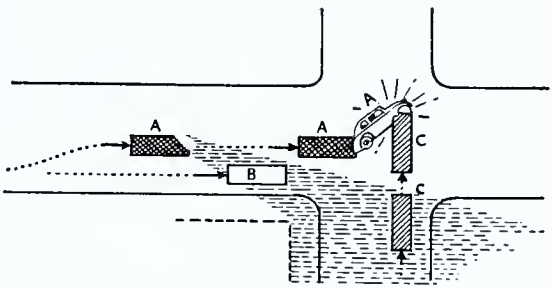
On curves or hills conditions become even more complicated, because of reduced visibility and the tendency to skid even on dry pavement. All good drivers wait until there is sufficient clear distance ahead, plus a comfortable margin of safety before trying to pass.

REDUCING HAZARDS OF PASSING—As we have seen, both the time and the distance required in passing depend on the difference in speed between the overtaking and the overtaken car. The driver of the overtaken car has certain other responsibilities besides pulling over to the right to insure a safe passing. He should play his part correctly, even though he may disapprove of the tactics of the passing driver. By cutting down his own speed, he can not only shorten the time and distance necessary for the other driver to complete the manoeuver, but he can

also protect himself from a side-swiping accident, if an emergency such as the one described above arises.

The driver of the passing car must first assure himself of sufficient clear distance ahead. Then, he may reduce the time and distance required by increasing his own speed. However, he should remember that the degree to which he can increase speed quickly is limited by the fact that a car accelerates less rapidly the faster it is going. The driver must in any event be careful to see that he is not traveling too fast to avoid hitting pedestrians or other traffic which may suddenly appear in his path.

RULES AT INTERSECTIONS—In most states, passing another car at intersections is prohibited by law, for experience has shown that this is one of the most serious driving errors. The overtaken car restricts the vision to the right of the driver of the passing car, while the driver in the overtaken car is prevented by the passing car from



seeing other traffic to the left. If a third car is proceeding rapidly toward the intersection from the right, the driver on the right can see it in time to stop, but the driver in the passing car on the left cannot, and a collision may be the result. As to traffic coming from the left, the tables are turned, and the driver in the overtaken car may be forced into an accident in a similar way. All passing manoeuvers decrease the zone of vision and are

intrinsically dangerous; rather than pass when the movement is not definitely a "sure thing," the good driver accommodates his speed to that of other traffic.

PASSING A DAWDLING CAR—The good driver is called upon to display particularly good judgment when caught behind a dawdling car. On a road where traffic in both directions is heavy, where curves, hills, and intersections are numerous, following a slow car is enough to tax the patience of most motorists. Poor drivers follow the offending car too closely, or take unnecessary chances in trying to pass it.

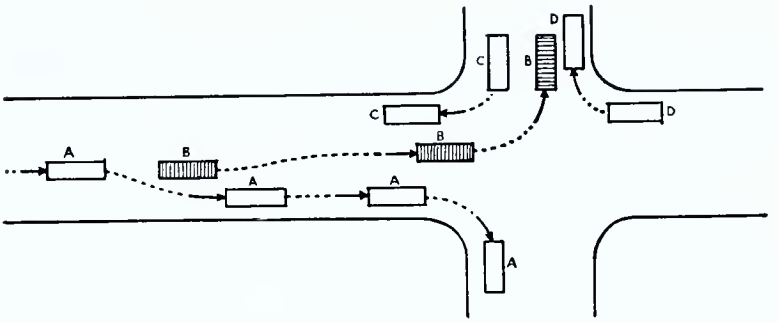
The good driver does two things: he leaves a long distance, say a hundred and fifty feet or more, between himself and the slow car, and he waits until there is plenty of assured clear distance ahead before attempting to pass. This long distance enables him to avoid bobbing frequently over to the left-hand side of the road when he wants to see ahead, and allows him to gather speed when he finally sees a good opportunity to pass.

In heavy traffic, a line of cars usually streams around a dawdling car. The good driver avoids joining this stream unless it is perfectly evident there are no cars coming in the opposite direction. He realizes there is always the danger that, while the car ahead may get around safely, he may not be able to do so without "cutting in."

MAKING TURNS

In turning right or left, the good driver carefully follows certain rules; these not only make driving easier for himself and others, but also help to prevent accidents. Above all, he makes his decision to turn far in advance, and thus avoids confusing other drivers by a sudden unexpected swing to the right or left when he reaches a corner.

RIGHT TURNS—A right turn should be made from the extreme right lane of the highway, or from a point



nearest the right edge of the road. The good driver shows he has made his decision to turn right in advance by steering his car carefully into the right lane long before the turn is made, thus making it unnecessary for him suddenly to cross the path of a car occupying a lane on his right. Then, he gives the proper signal (see Chapter VII), slows down and guides his car into the extreme right lane of the cross street into which he is turning. If pedestrians are crossing, or if traffic is heavy, he uses second gear in order to have better control over stopping and starting his car.

LEFT TURNS—In general, the same strategy is used in making a left turn as in making the right turn. The good driver steers his car to the lane or point nearest the center of the street, signals properly his intention to turn (see Chapter VII), and then slows down. If traffic is coming toward him from the opposite direction, he waits until it has passed, or until the driver of the first car in the line has indicated his intention to grant the right of way. Then he steers his car into the centermost lane of the cross road, getting thereafter into the right lane as soon as he has a good chance.

In a few places, the law requires the driver who proposes to make a left turn to bring his car to a stop nearest the *right* curb of the intersection. Then, after he has

looked both ways to assure himself that the road is clear, he may execute the turn. This procedure, however, is the *exception;* that quoted in the next paragraph above is the rule, and the good driver follows it always unless directed by law to do otherwise.

SIGNS

The motorist sees many signs that may appear useless to him. He often comes upon the warnings, "School, Go Slow"; "Road Slippery When Wet"; "Through Street, Stop"; or "Railroad, Stop, Look and Listen" at some time when school is not in session, when the road is dry, when no traffic is in sight on the through street, or when no train is approaching. Consequently, many drivers place little faith in signs, and ignore them.

The good driver, however, has the same attitude toward signs as a locomotive engineer. Men who run trains know that warning signs are posted for good reasons, and they are aware, too, that probably 999 times out of a 1,000 nothing serious will happen if the sign is disregarded. But they realize that such a procedure will at some time result in disaster and that this time may be the next time that the sign is disregarded.

The good driver not only respects the law of probabilities, but regards each roadside sign as a friendly attempt to warn him of some hazardous condition ahead. The sign, "Pavement Ends 300 Feet Ahead," tells him that there is likely to be a bump where the two types of road surface meet, and he reduces speed to avoid a severe jolt. He stops when he approaches a "through" street, realizing that this is a wise and right precaution. In fact, the good driver would rather be a trifle overcautious in obeying an unnecessary sign than run the chance of disobeying one that tells him of a truly dangerous condition ahead.

That unquestioning obedience to signs may protect the driver when the improbable happens, is illustrated by the following incident: Two young men, driving through a small town in Illinois, came upon a railroad crossing guarded by gates. Although the gates were not down, the driver nevertheless reduced speed when he saw a caution sign. A train went by, but still the gates remained up. The driver asked a bystander, "Don't they put these gates down for a train?" The bystander replied, "There must be something wrong over at the shanty. I'll go and see." He found that the watchman had died of a heart attack.

ANTICIPATING HAZARDS

"DRIVING AHEAD"—One of the outstanding skills of the good driver which he acquires by practice and attention to rules is the ability of "driving ahead." This consists of analyzing traffic situations before he nears them, and of visualizing scenes several hundred feet ahead as they will be when he reaches them. This is not guesswork. The good driver merely figures out what other drivers *may* do in order to decide what he *will* do to avoid a critical situation or an accident, regardless of how the other driver acts.

For example, let us consider the procedure of a good driver when he sees an approaching car being passed on a two-lane road. If most cars on the road are moving at thirty miles an hour, and the overtaking car starts to pass when only six hundred feet away, he realizes that the manoeuver may not be completed safely (see page 141). The stage is set for a head-on or a side-swiping collision. Therefore, he immediately slows down. If he decides to make a drastic reduction in speed, or a quick stop, he signals the cars behind him. Such quick and accurate reasoning avoids a possible accident.

A line of parked cars near a highway is full of potential

hazards. One of the cars may suddenly start out, or a pedestrian may emerge from between two cars. Anticipating trouble, the good driver proceeds slowly and is constantly on the alert.

The good driver realizes when he is passed that the passing car may be forced to cut in. Similarly, if a car directly ahead of him passes one farther front, he is conscious of the fact that it may have to cut in, forcing the passed car to stop suddenly. In both cases he regulates his speed accordingly.

"Driving Ahead" prevented an accident in the following situation. Automobiles were crossing in a steady stream over a bridge on a four-lane highway. A car was stalled in the right lane at one side. Good drivers quickly analyzed the situation, and all of them moved to the centermost lane. A new driver, failing to realize the significance of the action, continued to travel in the right lane. When he reached the stalled automobile, he discovered that it would be difficult to return to the center lane. Instead of waiting, he cut out sharply into the moving line. A collision was prevented only by the skill of the driver next in line who saw the dilemma, and sensed the probable actions of the learner.

JUDGING OTHER DRIVERS—The good driver is quick to judge the ability of other drivers, and avoids proximity to a poor one as much as possible. If he sees another car rush up to a red traffic light and stop with an abrupt use of brakes, he knows that he should remain as far from this car as traffic conditions will permit, that it is being driven by a poor driver whose actions are likely to be erratic and unpredictable. Likewise, he watches the man who blows a horn excessively, knowing that such a noise is a mark of the incompetent driver.

Poor drivers advertise themselves also by cutting in and "weaving" (see Chapter VII). The good driver

quickly spots the car that is "driving all over the road," and as long as it is in sight, is wary of it. He knows that one of the greatest menaces on the highway is the person who is chronically afflicted with the urge to pass other cars.

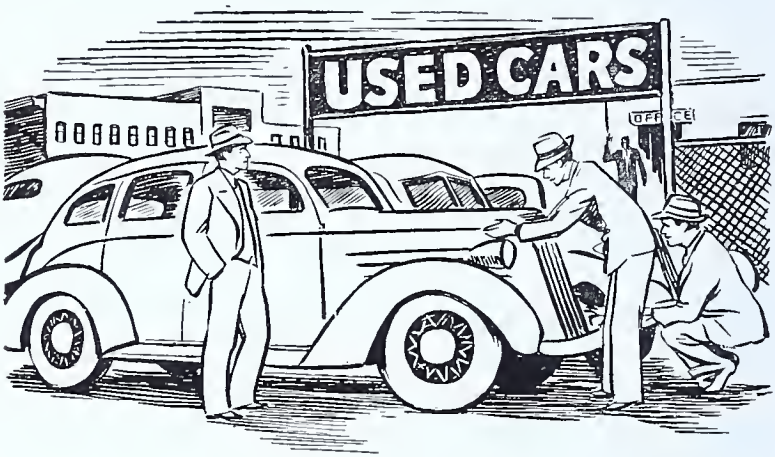
PLANNING ROUTES

In planning long trips, the good driver secures full knowledge of road and traffic conditions on the main highways over which he must travel. He learns the hours and days when roads will be congested. He tries to avoid being near large cities on week-ends and holidays. He learns how weather conditions affect travel on various routes, and in winter, avoids snow-bound or icy highways. He prefers to use good roads where traffic is comparatively light, rather than express highways where it is always heavy. In this, as in other matters, he tries to make driving as easy as possible.

AS OTHERS SEE THE GOOD DRIVER

Except for the fact that his family, friends and acquaintances enjoy riding with him, the good driver is not likely to receive much attention from anyone, particularly the motoring public. One who uses the streets and highways so correctly and unobtrusively is not seeking the plaudits of the crowd, for the crowd is too busy trying to protect itself from the wild misconduct, discourtesy and downright incompetence of poor drivers. Those who really appreciate him are the people who ride with him. A person who makes his passengers uncomfortable is not a good driver. The good driver's reward comes from safe, pleasant and economical motoring, and the satisfaction that any artist receives from doing his job well.

YOUR CAR AND HOW TO MAINTAIN IT



PROBABLY the first car owned by most young drivers is a second-hand or "used" car. It is probably also true that in the midst of the exciting adventure of buying his first car, many a boy forgets to apply the same critical intelligence he would exercise if the purchase were of a more routine and familiar nature, such as the buying of books, sports equipment or clothes. The result is that safety is lost sight of from the very start through the purchase of an unsafe car.

THINGS TO LOOK OUT FOR

We have no desire to advise prospective purchasers of either new or used cars in respect to the make, model, design or price of the cars they propose to buy, nor do we intend to discuss the comparative merits of any particular features which enterprising manufacturers may have put forth. There are other less dangerous and more

profitable things to do! However, there are certain features which are now standard and essential in an inherently safe car. These we shall set forth in their relationship to the art of good driving so that a purchaser may look for them in his own vehicle. Just as you would not enter a championship tennis match with a loosely strung racket or play baseball with a broken bat, so you should not attempt to enter the circle of good drivers with a sub-standard motor car.

VISIBILITY—Whether the car is new or used, one of the first things to look into is your ability to see adequately from the driver's seat. You should have almost a 180 degree angle of forward vision, and this can be had if the front pillars and side posts are built narrow enough (consistent with body strength) not to produce "blind spots" in your field of vision. Half-an-inch difference in the thickness of these pillars will increase the width of the blind spot fifty feet from the car by a foot or more. You should also be able to see the road ahead over the cowl and hood up to within a short distance from the car. If your vision is obstructed in either case, you may run into trouble on hills, at intersections, in rounding curves, and in avoiding near-by objects and pedestrians. While you are in the driver's seat, you should also determine whether you can reach clutch, brake and accelerator pedals easily from a relaxed position, and whether the seat itself is comfortable and conducive to riding ease.

STEERING—Your ability to turn the wheels quickly in an emergency as well as to drive reasonably long distances without unnecessary fatigue depends largely upon the efficiency of the steering mechanism. You should not purchase a car without taking the opportunity for a road demonstration, for such a test is the only way you can observe the good or bad features of the car that you are

considering. See that you do not have to turn the wheel too far in making an ordinary turn; this takes too much time and effort, and in an emergency you might fumble the job. See also that the wheels return "automatically" after the turn, and that road shock or "fight" in the wheel caused by bumps and rough road is at a minimum. Modern cars have "irreversible" steering gear which prevents most road shock from reaching the driver's hands.

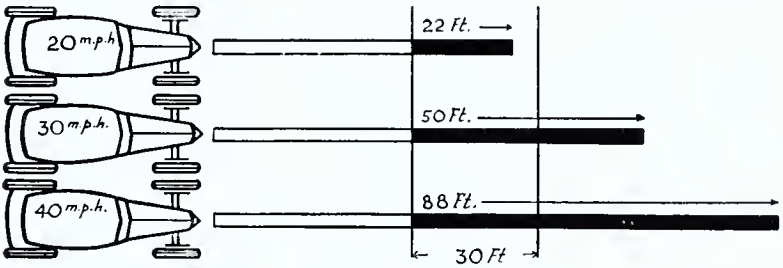
The wheel itself should be large and easily gripped, but it should not interfere with the driver's view of the road ahead. There should be plenty of room around it to permit a free and easy movement of hands and arms. Door handles or gadgets should not be placed where they may catch the driver's sleeve or strike against his hand or elbow.

While all mechanisms in the steering gear should move easily, they should not be loose. Periodic lubrication of the gears will usually keep them in good operating condition, but a free play in the wheel exceeding two and a quarter inches at the circumference should be corrected by a competent mechanic. The average car owner is not skilled enough to make precision adjustments in the steering gear or in aligning the wheels.

BRAKES—All through this book the importance of safe brakes for good driving has been emphasized. How fast you should drive is controlled by how fast you can stop. If your brakes are poor, unequal or otherwise out of adjustment, your chances for safety in an emergency are decidedly lowered.

New cars have safe brakes, but those in used cars may be badly worn or damaged. You should have them tested by a competent person, or if this is impossible, apply a simple test yourself. Draw two horizontal lines thirty feet apart on a dry, hard-surfaced, level road where there is no interference from other traffic. Drive the car

up to the first line at twenty miles an hour, and put on the brakes. You should be able to stop within the two lines, and a very good set of brakes will stop in twenty-two feet. If it can be done with safety make the same test at thirty and forty miles an hour, extending the lines



according to the chart shown here. Good brake performance at higher speeds is likely to mean more to your safety than at lower speeds.

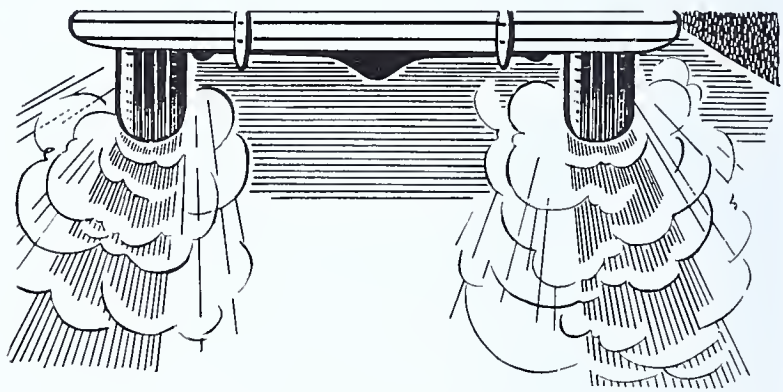
It is possible that the brakes may not only be too weak, but may act unequally as well. In other words, they may act less effectively on one wheel than on another, and in fact, differently on all four wheels. This will cause sidesway and possibly skids. Other things being equal, brakes that can be operated with a low degree of foot pressure are safer and better than those that require high pressure. In a heavy car correctly designed power brakes that do not "grab" undoubtedly contribute to safety.

The efficiency of brakes drops slowly and almost imperceptibly, as wear and tear on the brake linings and drums increases with use. The good driver makes it a practice for the sake of safety as well as economy to have his brakes tested at least every three thousand miles. Minor adjustments which remove inequalities in the way they take hold often help considerably to preserve linings. If brakes are in such a condition that the linings exert even a slight pressure on the drums when the pedal is not

applied, there will be an unnecessary amount of wear. In addition, the engine will be forced to do more work and gasoline consumption will be increased.

BRAKE LININGS—It is important that in making brake lining replacements you order those specified by the car manufacturer, for the characteristics of the linings will influence the way brakes operate, and the performance of the car has been predicated on the use of a certain lining. Before you buy the car it may be well to check the cost of renewed brake linings, for if the linings are far gone this will be an element in the cost of the car.

TIRES—Good tires are such an obvious necessity if one is to avoid blowouts, punctures and skids, and if one is to get the greatest braking efficiency out of his equipment, that good drivers insist upon having them. Likewise, they maintain them in proper condition by keeping them inflated at the pressure recommended by the manufacturer. Under-inflation increases wear and makes steering more difficult. Over-inflation reduces the shock-absorb-



ing qualities of the tire and places greater road strain on the car. Most service stations will check tire inflation as part of their customary free service to motorists, but

for the motorist who would rather do these things himself, inexpensive tire pressure gauges are available.

To obtain the maximum service from tires the driver should avoid quick stops and starts, for like skidding, they cause more wear than miles of travel. The black trail on the pavement left by a suddenly stopped car is nothing more than a smear of rubber ground off by the high friction between the tire and the road. High speeds, rough roads, heavy loads and high temperatures all help to reduce the life of tires.

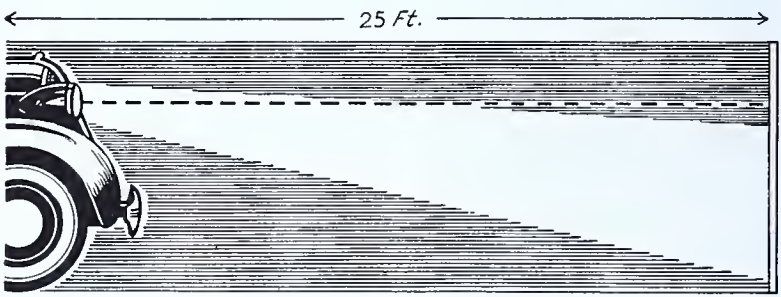
HEADLIGHTS—The headlight situation today is chaotic. Engineers cannot agree on what constitutes proper and standard performance, and state regulations differ widely. In consequence, advice given today may have to be withdrawn tomorrow when those responsible for creating standards are able to get together on uniform practice. Nevertheless, certain things are fundamental; it is necessary, for instance, if a motorist is to drive at night, that he have headlights of sufficient strength to illuminate the road ahead. And whatever the illumination may be, he must drive at a speed which will permit him to stop within the distance illuminated; otherwise, he is "outdriving the distance he can see ahead," a dangerous and indefensible practice.

If a car is to be driven on a straight road at night at thirty miles an hour, it must be able to illuminate the road at least eighty-three feet ahead. Such illumination will, however, in most cases have a dazzling effect upon an approaching driver. This is commonly now taken care of either by depressing the lights until the approaching car has been passed, or by diverting either the left-hand beam, or both beams, to the right. A car should be so wired as to be able either to depress the lights or to divert one or both.

The power and efficiency of headlights may be impaired

by several causes: the lens may get dirty; the bulbs may weaken; or the reflector may become smudged or tarnished. After a long trip, or where the car is used consistently on dirt roads, the lens is sure to become covered with a thin layer of dust, and the driver should wipe it off regularly. After fifteen to twenty thousand miles of driving, bulbs should be replaced. If the lenses are broken, they should be replaced promptly in order to save the surface of the reflector. This surface is usually a silver coating which tarnishes when exposed to the air. Then the efficiency of the headlight is permanently lowered until a new reflector is provided. Headlights may be dimmed also by a weak battery or by defects in the wiring system.

Proper adjustment of headlight beams is important, not only so that the driver can see the road but also in the interest of the approaching driver. Competent garages are equipped to make these adjustments correctly, and do so at not unreasonable costs. However, an acceptable procedure for the motorist who wishes to test his headlight adjustment is as follows: Stand the car on level



ground facing a wall twenty-five feet away. Draw a horizontal line on the wall at the level of the lamp centers. Then, draw two perpendicular lines the same distance apart as the two lamps. To be in adjustment, the bright

part of each beam should be evenly divided by the corresponding perpendicular line. The intensity of the brightest or upper beam should be concentrated not more than three inches under the horizontal line. If the lamps do not meet these conditions, they should be adjusted.

Properly adjusted lamps throw their light on the road where it is most needed. The greatest intensity of the light should be below the eye-level of approaching drivers where it will furnish a maximum of useful illumination and a minimum of danger.

TAIL LIGHTS—The tail light informs other motorists of the position of your car, whether in motion or parked. In consequence, it should be dependable, and you should inspect it frequently to make sure it works. It is very desirable that the light should be equipped with a reflecting device so that it will be illuminated when struck by the headlight beam of an overtaking car. This helps materially to make the car visible in case the tail light goes out.

OTHER SAFETY EQUIPMENT

WINDSHIELD—The windshield should be a clear, uncracked plate of glass in order to give the driver maximum visibility. It should be kept clean, for dirt and spots tire the eyes in the same way that a film of dust on eyeglasses produces eyestrain. Dirt on the windshield acts like a multitude of little mirrors, reflecting unwanted lights into the driver's eyes.

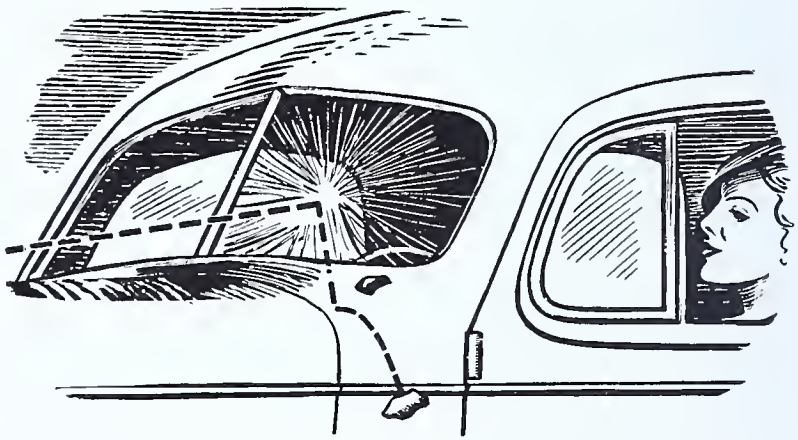
WINDSHIELD WIPERS — Every windshield should be equipped with a device for cleaning off rain, snow or other moisture, and it should be kept in good working order. The rubber blade should be soft so as to clean the windshield effectively, and its movement should not distract the driver. The preferred type of wiper has two blades: one in front of the driver and one on his right, so that two

holes are provided for him to see through. The hole on the right is important so that cars approaching from intersections on the right may be seen. The windshield wiper is usually operated by the vacuum in the intake manifold.

HORN—The horn should be in good working order. Under normal conditions, it should be audible for a distance of two hundred feet, and should not sound such a sharp or freakish note as to startle pedestrians or other drivers.

STOP LIGHT—Stop lights should have a high "attention attracting" quality. A difference in color or position from the tail light is considered better than a mere difference in intensity. When you put your foot on the brake the ammeter needle on the dashboard should move toward the "discharge" side, telling you that your stop light is working.

SAFETY GLASS—Many states are beginning to require safety glass as a fundamental part of the equipment of



new cars. Ordinary glass shatters, and in an accident at high speed flying glass produces serious and sometimes fatal injuries. Safety glass is glass that is so designed as

to reduce or minimize the danger of injury from flying glass when the glass is broken. Safety glass should not be subjected to excessive heat, as for instance, a candle.

INSTRUMENT BOARD—Speedometer, ammeter and other gauges on the instrument panel should be easily visible and quickly legible. If they are hard to see, the driver may spend too much time looking at them and involve himself in the dangers that come from inattention to the road. Or he may ignore them entirely, and in modern cars, high speeds can be developed almost unnoticed when the driver neglects to keep informed on what his speedometer registers.

MAINTENANCE OF OTHER PARTS

COOLING SYSTEM—If the engine is to operate smoothly and without damage, the cooling system must be kept in good working order. Its supply of water should be checked frequently, and if the water temperature registers abnormally high under ordinary conditions, a mechanic should check the source of trouble and make necessary repairs. During cold or wintry weather the radiator should be furnished with an anti-freeze solution of a kind recommended by the car manufacturer in his instruction book. Such a solution prevents the water in the cooling system from turning into ice. The same amount of water in the form of ice occupies more space than when it is in liquid form, and consequently may burst radiator pipes or split the engine's water jacket. In any event ice in the cooling system blocks the flow of water, and paradoxically prevents the engine from being cooled.

Most common among anti-freeze solutions are those made of wood alcohol, glycerine or ethylene glycol. Alcohols, although initially cheaper, have the disadvantage of evaporating easily and needing replacement and of being poisonous. Salt solutions should not be used because

they corrode the cooling system, while the use of kerosene involves a fire hazard. At the end of winter, anti-freeze solutions should be drawn off, and the radiator flushed. The cap of a frozen radiator should be removed with great care to avoid injury from escaping steam.

THE BATTERY — As we explained in Chapter II, the battery is charged by a generator driven by the engine. It may be weakened by an excess drain on its current from a frequent use of the starter, from the lights or from a radio when the engine is not going. When the car is moving at a reasonable speed, the ammeter needle on the instrument panel should point to CHARGE. If it points to DISCHARGE, under such conditions, there is probably something wrong with the electrical system which requires examination by a competent mechanic. Another symptom is sluggish action on the part of the starter motor, or a pronounced dimness or wavering in the headlights. If the battery fails, the car will not start, but if the car, in such an emergency, can be started by pushing it or by running it downhill, the ignition system can be operated directly from the generator.

Good drivers have their batteries checked regularly. The tops of the battery plates should always be covered with distilled water and frequent replenishment of this water is needed. Battery terminals should be kept clean in order to prevent corrosion. Corrosion eats away the connections and, by introducing resistance, decreases the voltage and therefore the effectiveness of the battery. Vasoline or special battery grease compounds should be placed on the terminals to prevent corrosion.

OVERCHARGING — During the summer months, when running with little use of lights and sometimes on long trips, there is some danger of overcharging the battery, although this is largely taken care of automatically. To prevent

overcharging, the motorist should have a mechanic regulate the generator so that it provides the lowest amount of current consistent with keeping the battery adequately charged. Or the driver can keep the lights burning during the daytime while the car is running, which, of course, is an unnecessary expense.

LUBRICATION—As was pointed out in Chapter II, lubricants must be used to overcome engine friction and to prevent destruction of the transmission and differential gears and universal joints. Wheel axles must be greased, and springs, steering gear, distributor, generator, and the water pump all require proper lubrication. In his instruction book the manufacturer has recommended the grade of oil or grease for each part, and these instructions should be followed to obtain best results. Most high-grade gasoline service stations have accurate charts of all these instructions.

The lubricating characteristics of oil change with temperature. A lighter oil is required during the winter than during the summer. Most brands of oil are graded by number in accordance with the standards of the Society of Automotive Engineers. SAE 20 is a light oil; SAE 50 is a heavy oil; the letter W after SAE number indicates a winter oil.

Considerable damage may be done to a car by using too heavy oils and greases in winter because of the fact that the car must be driven some distance before heavy oil or grease softens up enough to have a lubricating effect. In changing from summer to winter oils, the crankcase should be flushed out with a special flushing oil.

OIL FILTERS—Many cars are provided with filters in the oil system to remove grit and carbon from the oil supply. If it receives good care, an efficient filter can operate to save oil costs. It should be replaced when it becomes

clogged; otherwise, it may act as a hindrance to the flow of oil, and start trouble in the lubricating system. Most filters require replacement after eight to ten thousand miles of driving.

MISCELLANEOUS

CARBURETOR ADJUSTMENT—The carburetor can be adjusted to vary the richness of the gasoline-air mixture in the cylinders. A rich mixture makes starting easier but is wasteful of gasoline; a lean mixture burns at a higher temperature and uses less gasoline. Usually, carburetor adjustments should be made only to compensate for changes in weather or altitude and they require the skill of a competent mechanic.

CARBON—Carbon is an element in both gasoline and oil. Where these burn in the cylinders, a deposit of carbon is formed, particularly if the combustion is incomplete. This deposit changes the size and shape of the combustion chamber, and because it retains heat, it may seriously interfere with the burning of the gasoline-air mixture. It may, for instance, ignite the gas charge before the spark jumps the gap, upsetting the delicate timing of the engine and causing the engine to "knock." Any evidence of carbon should receive attention.

SPARK PLUGS—If the points of the spark plug are too far apart or too close together or covered with oil or carbon, a spark may not be produced. In consequence, the gas charge will not be ignited and no power stroke will be developed. Whenever the engine appears to lose pep, the spark plug points should be cleaned and the spark-gap adjusted.

ECONOMY AND DEPENDABILITY

Most drivers want not only a car upon which they can depend for smooth performance under difficult conditions,

but one that costs as little as possible to operate. Gasoline, oil, tires and repairs cost money.

To test the gasoline consumption of a car, fill the tank full of gasoline and note the speedometer mileage. After driving as many miles as may be desired, return to the same gasoline pump, with the car in the same position so as to make sure that the slope is the same, and measure the amount of gasoline required to refill the tank, noting the speedometer mileage at that point. The car should carry the same load of passengers and freight when the tank is refilled as when it was filled in the first place. The difference between the two mileage readings divided by the number of gallons of gasoline used will furnish a fairly accurate measure of the gasoline consumption in miles per gallon.

Heavy blue exhaust smoke indicates an excessive consumption of oil, and is a sign of possible engine trouble. In any event, the engine is wasteful of oil, and will consume it in large quantities, adding to the expense of operation.

Tire wear is affected by wheel alignment, brake adjustment and under-inflation. If the wheels are out of true alignment, the tires will wear far more rapidly than under ordinary conditions. A well-equipped garage can test and remedy this condition.

PREVIOUS OWNER—In buying a second-hand car no single item will give the purchaser more important information than the driving reputation of its former owner. If he was a good driver, careful for his own safety and able to care for and get the best performance out of his car, the chances are that the car will be in excellent condition. On the other hand, if the former owner was a poor driver, and particularly, a "spectacular" driver, the car will be in questionable condition to say the least. If it has dents in its fenders or obviously new or replaced

fenders, who can tell how serious the accident was? Perhaps the frame has been twisted or the engine moved from its proper position. Collisions place a heavy strain on all parts of the car, and if the frame has been wrecked so that the wheels are out of alignment, repair and upkeep bills will be plentiful and heavy.

EMPLOYING A MECHANIC—It is not necessary for the average motorist to know all the ins and outs of motor mechanism, but if he is ignorant he should be definitely conscious of that fact. If he is conscious of his ignorance he may save himself trouble and money when he sets out to buy a used car by hiring the services of a skilled mechanic. Such a person is trained to know the ills of a poor engine; he can recognize excessive wear of cylinders, pistons or bearings, misalignment of wheels and gasoline and oil waste. He knows also the characteristics of the various makes of cars, and can advise on the probable cost of repair bills. There is no excuse now-a-days for buying a poor used car for there are abundant facilities for finding out the condition of a car; its troubles can be diagnosed at least as accurately as those of a human being. The use of such a service is equally important in maintaining a car after it has been bought.

BREAKING IN A NEW CAR

Detailed instructions are provided by the manufacturer or dealer for the purchaser of a new car, telling him the kind of care he should take of his car during the first few thousand miles of the car's life. Usually these directions recommend maximum speeds for the first few hundred miles such as: *not over twenty-five miles an hour for the first five hundred miles: not over thirty miles an hour for the second five hundred miles.* Special breaking-in oil may be required for lubrication during this period.

The reason for all this is that the moving parts of the

new car do not slide over each other as smoothly as they will later on. The bearings have slightly rough surfaces, and if moved too fast, are likely to do permanent injury. If the breaking-in directions are followed to the letter, the parts will gradually adjust themselves to each other. Nothing is more important for the condition and life of the car than the exercise of the utmost care during the first thousand miles. Many a car has been ruined the first few hundred miles.

INSPECTIONS

It is becoming a well-accepted principle that an automobile should have a competent inspection of its safety features at least twice a year, in the fall and in the spring. Eleven states now have compulsory motor vehicle inspection laws. A number of cities also require inspections and operate municipal testing stations. Official examinations usually test at least steering apparatus, brakes, headlights, stop-lights and tail-lights, horn and windshield wipers. An official seal is placed on the car if it measures up to standard; otherwise, its owner must have it repaired. The result of one series of inspections in which 22,000,000 cars in several states were examined over a period of years indicated that three out of four cars on the highway were defective in at least one piece of safety equipment. Sixty per cent of the cars needed better

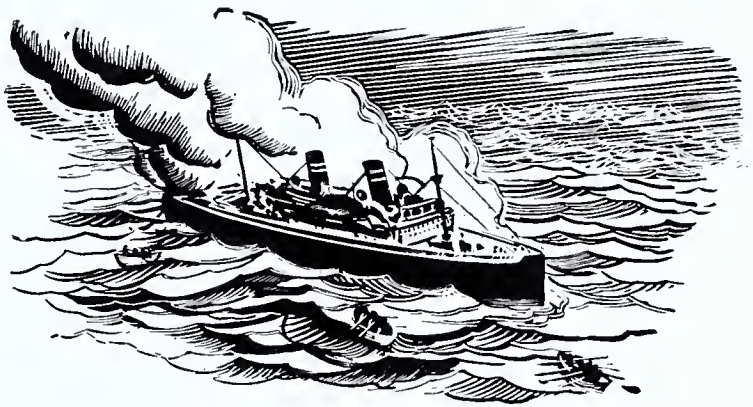
brakes. While not over fifteen per cent of accidents are due to faulty equipment, such inspections produce a distinct improvement in the accident records, as in Memphis, where the fatal accidents dropped twenty-five per cent after the inspections were started. This effect is partly

due to the fact that the operation of an inspection system serves to keep the safety point of view in evidence.

Good drivers check the details of car condition of their own free will. A good driver looks at tires to make sure they are properly inflated and sees whether lights are working properly. The ammeter and oil gauge tell him whether the electrical and lubricating systems are functioning, and then, as he starts out, he makes an immediate test of his brakes. With the good driver this procedure becomes a habit, one of the open secrets of his ability.

CHAPTER XII

AUTOMOBILE ACCIDENTS

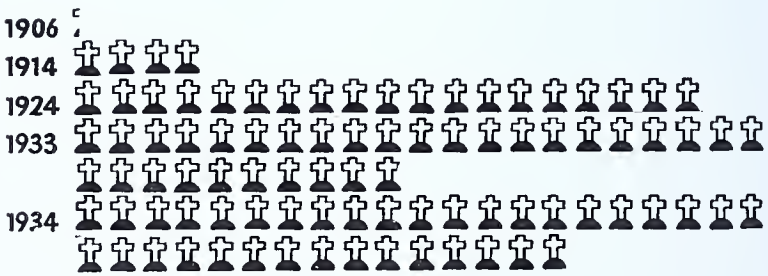


One fall evening in the year 1934, the steamship Morro Castle burst into flames off the Coast of New Jersey. All through that hideous night hastily mobilized squads of men and women labored to help the regular coast guard patrols in the work of rescue. But by morning 125 persons, passengers and members of the crew, were dead. For weeks the disaster occupied prominent space in newspapers throughout the country, and in many places an aroused public opinion demanded assurance that the victims of the Morro Castle fire would be the last wholesale sacrifice to accidents at sea.

Yet, on the very day that the Morro Castle burned—and on the next and the next and the next, in fact on every day throughout that year, nearly as many men, women, and children lost their lives in automobile accidents on our streets and highways. For every one that was killed, thirty more were seriously injured, many of

them permanently crippled and maimed. No newspaper heralded this mass sacrifice; no public opinion became aroused to demand a halt to such ruthless and unnecessary slaughter. Why? Partly because we had by now become accustomed to hearing at the end of every year that 30,000 or more automobile fatalities had been recorded. So in 1934, when we learned that death had taken an all time high of 36,000 lives, we accepted the fact with comparatively little emotion.

Up to this point in this book we have treated the subject of man and the motor car as a problem of "*good* driving." We have purposely said as little as possible about the automobile accident situation, about the problem of "*safe* driving." The time has now come when we must discuss traffic accidents as a major concern of modern civilization. Therefore, this and the remaining chapters of this book will be devoted largely to that subject.



EARLY ACCIDENT STATISTICS—Ten years after the automobile first appeared on our streets, in 1906, the Census Bureau reported 183 fatalities from automobile accidents. In 1914, the total was more than 4,000; in 1924, more than 19,000; and in 1934, 36,000.

In the early years it seemed natural to assume that the great increase in traffic accidents was due to the great increase in cars on the road. In fact, many felt that it was

a cause for thanksgiving that fatalities and injuries had not kept pace with the enormous annual increase in motor car registrations. Since 1927, however, this easy alibi has been lacking, for while registrations have increased eleven per cent, accidents have jumped fifty-five per cent. Judging by the unprecedented increase in fatalities in 1934 over 1933—36,000 as against 31,000—the rate of increase is growing steadily larger.

WORSE THAN WAR—Today motor vehicle accidents take more American lives than either war or crime. In eighteen months of the World War, 50,510 members of the American Expeditionary Force were killed in action or died of wounds. In a similar peacetime period from January 1, 1934 to June 30, 1935, 51,500 persons were killed in motor mishaps. It is a fact also that while gunmen in this country kill one, automobiles kill six.

THE COST—What does this slaughter cost? Estimates of the total economic loss from motor accidents which include the value of damaged property, wages lost by injured workmen, medical and hospital fees, and so on, range from one and a half billion dollars annually to two and a half billion dollars. In any event it is more than four times our annual loss by fire, and nearly equal to the entire cost of our public school system. It is more than the value of the total output of new cars by the entire motor car industry; and in a sense, therefore, wrecking cars costs more than buying new ones.

THE MEANING—It is difficult for the individual to comprehend the meaning of automobile accidents in personal terms. Ask yourself this question: "What do traffic mishaps mean to me?" And then fit these facts into your answer: Every day, all day and all night, year in and year out, one person is killed every fifteen minutes and one person is injured every thirty-one seconds. In a family

of three children, one child now faces the probability of being killed or injured in a motor accident before he lives out his normal span of life. According to the National Safety Council, if conditions remain static, one out of two persons may expect to be injured within the next fifty years; one out of four within the next twenty-five years, and one out of five in the next twenty years. In its publication, "Accident Facts," the Council says, talking directly to the American public: "Probably you have near relatives and close friends to a total of at least twenty. If so, these figures mean this to YOU: unless each person in your group is more careful than the average person, one of the twenty will be injured or killed in a motor accident within the next five years."

THE AUTOMOBILE KILLER—What does the automobile killer look like? Is he a separate species set apart from the rest of the world? In an article that appeared recently in *Harpers Magazine,* William Junkin Cox of Yale University had the following to say: "If anyone should wish to look upon a person who will kill one of his fellows before twelve months are out, he need only halt and look at the drivers of the first seven hundred automobiles that pass. If the street is a busy one, this will require only half an hour. Last year (1934) there was one automobile fatality for each six hundred and fifty cars on the road."

THE AUTOMOBILE "ACCIDENT"—In reality there is no such thing as an automobile accident, for as applied to motor mishaps, the term "accident" is a misnomer. An accident is properly an unforeseen, an uncontrollable happening. With automobiles this is far from the case. Automobile accidents do not happen, they are caused, and only a remarkably small number can be traced to mechanical failure on the part of the car itself, to a defect in the roadway or to any other "cause" beyond the control of the

driver. Even in these mishaps, the fault rests largely with the driver who failed to keep his car in first class mechanical condition or who neglected to exercise adequate caution in driving over an inferior kind of road.

THE CAUSES OF TRAFFIC ACCIDENTS

At present, the reporting of automobile accidents on a national scale is in a primitive state of development. Many states ignore accident reporting entirely while others maintain systems which vary in accuracy and adequacy. There is no uniform method which provides the statistician with sufficient national data to indicate on a countrywide scale the real nature and causes of our motor mishaps. Enough is known, however, to classify accidents according to their cause, in three general groups: (1) those arising from defects in the highway or in the vehicle itself; (2) those caused by pedestrians; (3) those caused by the driver. The last group is known to be by far the most important. It is agreed, too, that the majority of accidents are the result of a combination of causes rather than of one particular cause.

DEFECTS IN THE VEHICLE AND IN THE HIGHWAY—The day of the superhighway has merely dawned. It will be years, perhaps decades, before engineers can rebuild and adjust our highway systems to suit the needs of modern traffic, and even then we shall probably be able to deal only with our main arteries. As it is now, many of our main interstate and intercity highways and most of our city streets are still adequate only for the needs of a horse and buggy era. Thousands of miles of road are too narrow, with curves too sharp, unbanked or banked the wrong way, with poor bridges and approaches to bridges. In many places road surfaces are too rough, too slippery or otherwise unsafe. The public responsibility for providing adequate artificial illumination at night not only

within city limits but also along rural highways has only recently been given any consideration at all by public officials. Certainly it must soon be recognized that lack of visibility is one of the outstanding reasons for the fact that automobile accidents at night are more serious than during the day. Once that recognition is had, adequate night time illumination will probably become a part of our highway planning.

According to the National Conference on Street and Highway Safety, mechanical defects in motor cars are responsible for about 15 per cent of the total number of accidents. This does not mean that the cars themselves are inherently defective, for it is admitted that as they come from the factory they are in as safe condition as present day mechanical science can make them. The defects develop as the result of depreciation, neglect or abuse, and therefore, can be charged almost entirely to the owner or operator.

It was pointed out in the last chapter that many states are now conducting periodically, official inspections of all motor cars registered within their jurisdictions. The importance of this work was emphasized in a report of the inspections of some 22,000,000 cars covering a period of

several years. The report showed that three out of four cars operating on the highway were defective in at least one safety factor. The most important defects discovered were in brakes, headlights, steering mechanisms and tires, and these are the principal mechanical "causes" to which 15 per cent of our accidents are attributed.

THE PEDESTRIAN—Up to this point we have said little about the actions of pedestrians which lead to motor

vehicle accidents. Since Chapter XV is devoted entirely to the pedestrian, it seems sufficient here only to point out that he is a major factor in the traffic accident situation. Nearly half of those killed every year are pedestrians, and although the automobile driver must bear most of the blame for their deaths, nevertheless, pedestrians themselves contribute amply either by heedlessness or stupidity to these tragedies.

Five out of every eight pedestrians killed in 1934 were involved in accidents while crossing streets in the middle of the block, crossing intersections against the traffic signals or diagonally, darting out into streets from behind parked cars, or while walking along rural highways. In most of these cases the pedestrian involved could and should have taken simple precautions which would have safeguarded his life. One out of ten pedestrians killed was a child playing in the street.

In its booklet "Thou Shalt Not Kill," an analysis of traffic accidents for 1934, the Travelers Insurance Company says: "Pedestrians run across streets in the middle of the block or against signals because they feel that little if any more protection is given them at properly designated crosswalks or when they wait for signals. They may know it is dangerous to walk along rural highways,

but since paths and walks have not been provided, what else is there that pedestrians can do but take their chances with automobiles?" Nevertheless, as its statistics show, the rate of death per pedestrian accident was 45 per cent worse crossing in the middle of the block than at intersections and 74 per cent worse crossing against signals than with signals.

THE DRIVER—Nearly every agency actively interested in the problem of motor accident prevention is concentrating the bulk of its energies on the problem of the man behind the steering wheel. Upon him rests the greatest share of responsibility for automobile accidents, and it is mainly his fault that the automobile has exacted such an overwhelming tribute in life, limb and property damage. The problem of the driver is the great problem of traffic accident prevention; what has been done and what can be done to solve it will be treated in the next chapter.

Meanwhile, let us examine why he causes accidents. In the first place it must be admitted that the great bulk of drivers on the road today had no formal training in the art of driving. Most of them learned the simple process of shifting gears or steering by watching others or through being taught by a relative or friend. Both methods are based upon the principle of imitation and involve learning bad techniques along with good ones. In other words, one bad driver might teach half a hundred other drivers and they would turn out to be bad in one way or another. In some states drivers' license laws have helped to prevent the worst drivers from appearing on the road, but the system is neither infallible nor adequate in this respect. Thus, we now have at least three generations of drivers on our highways of whom a great number may be ignorant of anything but the raw fundamentals of operating a car. And some may not even know all of these for a great many accidents are caused by drivers who

have never learned the proper methods of making turns, of backing or signalling; they do not observe right of way rules, stop signs, or traffic signals to say nothing of their obligations toward pedestrians.

SPECIFIC CAUSES—Because they are actually defective in mind or body—they have bad eyesight or are not strong enough to control a heavy vehicle. Or their senses are dulled by alcohol, or fatigue, or carbon monoxide or by any combination of these things.

The greatest number of drivers who have accidents, however, are, as the National Safety Council points out, "neither physically defective nor ignorant of traffic rules. They don't really want to have an accident, but neither do they sufficiently want *not* to have one. They take chances by going too fast; they pass other cars on hills and curves; they cross railroad tracks without looking; they do not slow down at intersections; they expect other drivers and pedestrians to get out of their way."

	Number of Accidents	Per Cent	Persons Killed	Per Cent	Persons Injured	Per Cent
Exceeding speed limit..	123,980	22.1	6,850	31.0	134,300	22.1
On wrong side of road	92,570	16.5	3,470	15.7	102,090	16.8
Did not have right-of-way	136,880	24.4	2,740	12.4	159,220	26.2
Cutting in	19,630	3.5	460	2.1	22,490	3.7
Passing standing street car	2,810	.5	180	.8	3,040	.5
Passing on curve or hill	9,540	1.7	470	2.1	10,330	1.7
Passing on wrong side.	2,800	.5	70	.3	3,040	.5
Failed to signal and improper signaling ..	28,610	5.1	220	1.0	33,420	5.5
Car ran away—no driver	3,370	.6	240	1.1	3,040	.5
Drove off roadway....	60,590	10.8	3,820	17.3	57,120	9.4
Reckless driving	53,290	9.5	2,740	12.4	55,300	9.1
Miscellaneous	26,930	4.8	840	3.8	24,310	4.0
TOTAL	561,000	100.00	22,100	100.00	607,700	100.00

The importance of these and other errors charged to drivers *alone* are indicated in the table from "Thou Shalt Not Kill," shown on page 175.

OTHER ACCIDENT FACTS

URBAN VERSUS RURAL RESULTS—For the purpose of national accident reporting towns of less than 10,000 population are considered rural districts; towns of more than

10,000 population, urban districts. In the last several years there has been a steadily increasing volume of rural traffic, largely because the increased mileage of improved highways has attracted a greater number of motorists to the open road. With this increase in traffic has come a sharp increase in accidents.

In 1924, motor vehicle deaths in rural districts made up fifty-two per cent of the national total; in 1934, they had risen to sixty-four per cent. This does not mean that the number of deaths in urban districts has declined; it means only that the rate of increase in the country has been more rapid.

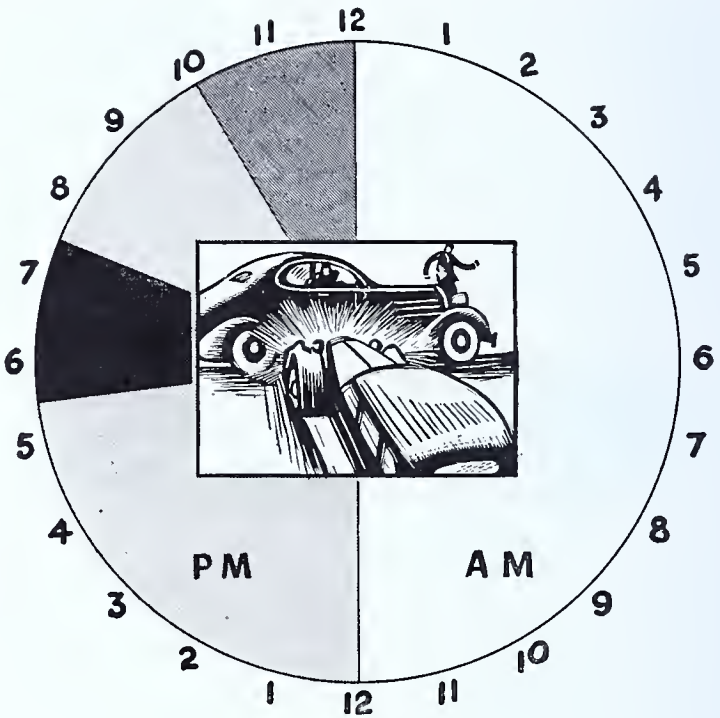
As might be expected there were fewer pedestrian deaths in rural communities than in urban; 7,550 as against 8,650 for 1934, respectively. But the urban total of deaths from collisions between motor vehicles was only 2,100 as compared with the 6,500 rural total for the same type of accident. Collisions between motor vehicles and

fixed objects brought 850 deaths in 1934 in urban districts, but they account for 3,350 in the country. As for accidents of the non collision type (drove off roadway, etc.), only 450 persons lost their lives in cities, while 4,050 deaths from such causes occurred in rural districts in the same year.

On the whole, in 1934, 12,900 deaths occurred in urban districts; 23,100 in rural. Thus, the cities lead in pedestrian deaths, the urban districts lead for all other types.

WHEN ACCIDENTS HAPPEN—Between the hours of 6 P.M. and 6 A.M. traffic is only one-fifth as heavy as during the day. Nevertheless, in that period, fatal accidents are at a peak. A survey made by the Connecticut Department of Motor Vehicles showed that two-thirds of all traffic deaths in that State occurred in the night time hours. The worst hours are between 5:30 and 7:30 P.M. when men and women are usually hurrying home from work. After that time accidents decline until the period between 10 and 12 P.M., when they rise sharply again to a point almost as bad as for the earlier period.

SEASONAL RESULTS—It is not true as popular impression would have it that accidents are more numerous during the summer months. For five years from 1929 to 1933, the worst period of the entire year was during September, October and November. In these months the average monthly total was 3,137 deaths as against a June to August average of 2,804. The bad record for the autumn months is probably due to the decrease in daylight.



THE YOUNG DRIVER

Up to the present time, the young driver has not been a credit to society. As far as can be learned he has a decidedly worse record than the average for all drivers. He has been technically proficient but has lacked judgment; he has been reckless; he has had the wrong attitude of mind. If we are to approach the traffic problem successfully, we must have a new generation of drivers; a generation which will not take pride in driving recklessly, but one which will be proud of its ability to drive safely. For this new generation we look to the boys and girls in our high schools; they must not fail us!

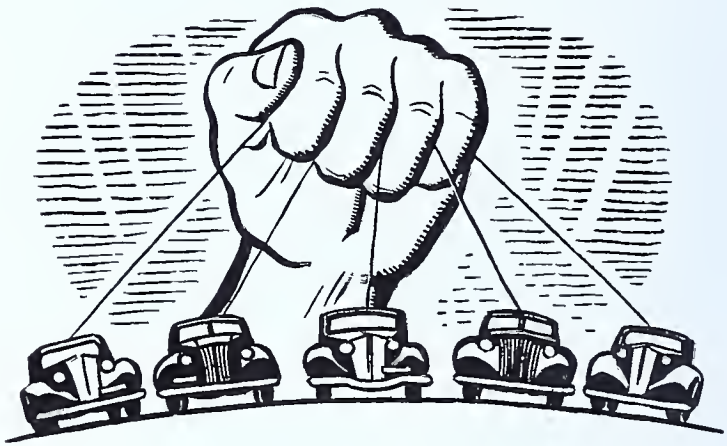
CONCLUSION—One of the more tragic facts about automobile accidents is that the cream of our population is

sacrificed, the bulk of those killed being between the ages of fifteen and sixty-four. Statistics show that 1,470 persons up to the age of four were killed in 1934; 3,820 between the ages of five and fourteen; 26,030 between the ages of fifteen and sixty-four; and 4,680 persons over sixty-five years.

Each of these men, women and children died a painful, personal death,—a sacrifice to reckless, uninformed and unintelligent driving. Their deaths make it only too plain that automobile accidents on the streets and highways of the United States are an intolerable menace,—a new kind of Public Enemy Number One.

CHAPTER XIII

*IT CAN BE DONE**



HISTORY shows that whenever a public menace begins to strike too close—we act. We are a patient people and not easy to arouse, but once we are awakened, we go at what we have to do in a constructive and effective way.

Witness the war on disease,—diphtheria, for instance. When thousands died of this malady in a single year, an aroused public opinion demanded protection. Men with microscopes and test tubes were brought into action, and not only was a broader knowledge of diphtheria laid before the public, but an effective program of cure and prevention was evolved. Today, hardly a school child leaves the elementary grades until he has been inoculated

* The argument and material in this chapter were dramatized under the same title in a sound film, "Death Takes No Holiday," produced by the National Bureau of Casualty and Surety Underwriters some months previous to the publication of this book, and were thereafter made available for publication in other forms.

against diphtheria. The result is that the threat of this deadly disease among boys and girls has been immeasurably lessened.

Take another kind of warfare,—that we are carrying on against gangsters. For years we watched the melodramatic exploits of gunmen as they rose to wealth, power and notoriety. For a time we were indifferent to the spectacle, but when a wave of kidnapping swept over the country, killing even babies in its ruthless career, public opinion again demanded protection. Encouraged and helped by this long-needed support, national, state and local crime hunters redoubled their efforts. And all over the country notorious criminals and bands of gunmen were gathered into their nets.

And now a new menace has arisen to challenge the power of public opinion,—death by motor traffic. The shadow that it has cast across our highways has grown steadily larger year by year until today not a man, woman or child is safe from it. Yet we have been indifferent. People have said: "Perhaps this is a necessary price we must pay for the convenience and luxury the automobile has brought us. Besides, what can you do about it? Accidents will happen." The point is, accidents don't just happen. They are caused, and these causes can be removed. How? First, by convincing ourselves that the job can be done, and then by arousing the full force of public opinion to see that it is done, by doing individually and collectively those things that will make good driving and safe walking second nature. The rewards are astonishingly great, for if we were to use effectively all the traffic knowledge we now have at our command, we could slash our automobile accident toll in half in an amazingly brief time. More than that, we could do it with an actual increase in the efficiency of moving traffic.

Why then has it not been done? The trouble is not

that we did not know what to do, but that we lacked the collective will and energy to do it. We have treated our traffic problem with almost complete indifference. When only ten states have drivers' license laws that are at all adequate; when half a dozen states have set no minimum age limit for drivers, so that a child can step from a sidewalk scooter to the wheel of a hundred horse power motor car without violating any law; when a city of two hundred thousand population can have an average record for the last four years of forty thousand tickets "fixed" a year through political influence, it cannot be said that we have treated our traffic problem seriously.

We need to wake up. We are going to wake up! During the last few months of 1935, a wave of alarm and indignation against traffic accidents began to sweep over the country; this may have in it the same potent qualities that were responsible for our attack on disease and crime. If this should prove to be the case, the public will find ready for action a traffic safety movement which has been under way for years. For traffic engineers, educators, legislators, psychologists, policemen, government officials, citizens and organized groups have been busily building a fighting machine that has proved successful wherever a community was ready to act.

SAFETY AND EFFICIENCY

The possibilities in organized safety work are neither new nor untried. Twenty years ago accident conditions in industry were as intolerable as they are in traffic today. Industrial executives finally undertook the work of prevention but with the full expectation that they would pay heavily for it in reduced efficiency. They felt that the operating of guarded machines and the wearing of goggles would slow up production. Exactly the opposite proved to be the case. Many industrial plants reduced their

accidents as much as eighty or ninety per cent, but along with this increase in safety went not a decrease but an increase in production.

The explanation of this was given many years ago by Sidney J. Williams of the National Safety Council by means of the following example: Suppose a casting falls off a loaded truck and seriously injures a man. For every such case there will be hundreds of cases where castings fall off trucks without hurting anyone. But in every one of these cases there was inefficiency; either the casting was broken or the truck had to be stopped and repiled. The injury to the man was only the spectacular evidence of an underlying inefficiency. If we eliminate the causes that produce accidents, we shall at the same time rid ourselves of the causes that produce inefficiencies. In fact, industrialists now insist that the safety movement has played an outstanding part in bringing about the increased efficiency of modern industry.

There is no reason why a similarly organized movement should not produce comparable results in reducing traffic accidents. When we begin to move traffic more safely, we shall find that the conditions which have produced accidents have, also, been responsible for slowing up our traffic flow. Bad traffic conditions and violations of the traffic laws frequently result in accidents; they more often result in traffic jams. The economic cost of delayed traffic under our present system is equal to, if not more than, the economic cost of accidents. When the public begins to appreciate the tribute now exacted by our chaotic traffic conditions we may expect a real housecleaning.

The practical question before us, then, is: What needs to be done and what can be done? If we can count on an intelligent and an aroused public opinion, there are three effective points of attack: education, enforcement, and engineering.

EDUCATION

Of these education is the most important. How to be safe from wild beasts and human enemies and how to do such things as move noiselessly through the forest was part of the training of primitive man. Our complicated modern civilization has developed hazards which are no less menacing. To meet these, there are attitudes of mind, there are habits, there are techniques which cannot be adequately learned except through formal education deliberately planned and executed. The home is no longer able to take care of the situation. In fact the modern home is such a dangerous place in itself that the safety wisdom that children are gaining at school is proving to be one of the most potent influences in the improvement of conditions in the home.

ELEMENTARY SCHOOLS—The work in the elementary schools has been done chiefly in the class room but partly on the street through school boy patrols. Some 250,000 boys in nearly a thousand cities are serving in these units. Their work is to guide children across the street near school buildings and to help in directing traffic within the buildings as well. The approved school boy patrol does not direct motor traffic; its job is to look out for the children. The indirect, educational effect upon the patrol boys themselves is as important as the direct effect upon the children. The work in the class room is of even greater significance. Here is where the attitudes of mind and the habits that are so necessary in the creation of a citizen of the automobile age are mainly formed.

The work in the schools has been an outstanding success. In 1922 there were 11,107 traffic fatalities of adults and 4,219 of children of school age and under. In 1934 the corresponding figures for adults were 31,500 and for children 4,500, an increase for adults of over 20,000, an increase for children of less than 300. Reduced to per-

centages, these figures show an 184 per cent increase for adults and a 7 per cent increase for children. This difference in trend represents a saving of 7,500 children's lives a year. In other words, if accidents to children had increased at the same rate as accidents to adults, 7,500 more children would be killed each year than is actually the case. The principal factor in this improvement has been education.

HIGH SCHOOLS—Until recently safety education in the schools virtually ceased with the elementary grades. Now, however, another piece of work that will carry safety education to its logical conclusion is ready to be undertaken by the high schools—the making of good and safe drivers. A man is not allowed to become a locomotive engineer until he has had a thorough experience as a fireman; a man is not allowed to pilot an airplane until he has had thoroughly adequate instruction and experience in flying. No such provision has been made for the training of drivers. And yet an automobile is potentially a more dangerous machine than a locomotive, for it has no fixed track to run on, no right of way and no mechanical devices to stop it if it gets out of the driver's control. Somewhere in our social and educational system we must find a place where people who are to drive cars can learn to drive them properly, can learn the *art* of driving.

The high school is evidently the place where such work should be done. For one thing the work must be carried on at such an age that the student will not already have learned to drive by himself, for reeducation is difficult and unsatisfactory. This will bring such instruction into the junior or senior years in the high school.

The work falls into two classifications: first, a study of the theory of driving, including such a background of knowledge and thinking as is necessary as a basis for the use of the automobile, and second, practical work in the

actual driving of the car. Hundreds of schools are already giving the kind of courses that fall into the first category.

No such progress been made in the second or laboratory stage of the work. One high school notably, and possibly a few others, have undertaken to give actual driving instruction. The results secured show that a type of driver can be developed by such training that is in quite another class from the average, untaught driver of today. To what extent and how rapidly this kind of work can be undertaken is an open question. The practical difficulties and expense involved will be considerable. Nevertheless, it is hard to see how there can be any satisfactory and permanent solution of the traffic problem that is not based upon a thorough training in actual driving, not the mere mechanics of driving but the formation of attitudes of mind interpreted into action and habits through contact with actual experiences on the highway.

ENFORCEMENT

Enforcement has to do with putting into effect the codes of good driving that have been established either on a basis of custom, ordinance or law. It presupposes that such laws and ordinances have already been set up where they were needed. And yet nothing is more characteristic of our traffic situation than the absence of such laws, unless it may be their abuse where they exist.

DRIVERS' LICENSE LAWS—The two outstanding successes in the traffic safety field have been the work with school children and the work with commercial drivers. Both of these are characterized by the existence of authority, represented in the one case in the person of the teacher and in the other case in the person of the executive. In order to control the traffic situation the driver must similarly be made responsible to some authority. Otherwise no pressure can be brought to bear upon him. The purpose of

drivers' license laws is primarily to make the driver responsible. He is given a license to drive, not as a right, but as a privilege based upon proved character and ability and subject to forfeiture if it should be found later that he is not qualified. This is so obviously necessary as a basis for any effective control that it is not even debatable. Without a drivers' license law, we shall have our streets filled with drivers who are physically, mentally, or morally unfit, types of persons that never should be allowed to assume the responsibility for driving a car.

MINIMUM AGE LIMIT—It is just as necessary that provision be made for prohibiting driving before the age at which reasonable ability and discretion can be expected. Some states have no such laws, and in other states the age limit is much too low. What are probably the best laws, require a person to be eighteen years of age before he can get a regular drivers' license but allow him to have a junior license, containing certain restrictions, at sixteen.

ENFORCEMENT AGENCIES—The principal enforcement agencies are the police and the courts. The city police operate on the streets and the state police on the highways. Both have the power to arrest for violation of traffic laws. The work of the police must be supplemented by courts in which the cases that thus develop can be tried.

The effectiveness of enforcement procedure is measured in a variety of ways, among them: the adequacy of the police force, the training for the work, the means by which accidents and violations are investigated and prepared for trial and the way in which the cases are tried. There is all the difference in the world between a good quality of enforcement on the one hand and poor enforcement on the other.

TICKET FIXING—The most flagrant abuse in the field of enforcement and the most serious threat to our ability

to deal effectively with the traffic problem is the setting aside of summonses for traffic law violations by authorities who have yielded to political pressure. Such a system of political favoritism in a community strikes at the very root of effective enforcement, for an officer will not continue to subject himself to the unpopularity that will come to him from making arrests if he knows that these arrests will be set aside.

Any self-respecting community can stamp out ticket fixing. Many communities have got rid of it entirely, but in some it is now so rampant as to have completely demoralized the work of the enforcement agencies. Communities that have eliminated this evil testify that the job can be done if it is done completely. In other words, persons in authority are only too glad to refuse such improper requests if they are assured that no one else can and will grant such favors. No half-way solution is possible.

There is no more searching test of the earnestness, the sincerity and the integrity of a community than the question of whether its citizens are willing to face the consequences of their misdeeds on the highway; it is essentially a problem of the individual, whether he has the character and the stamina to face the music. Ordinarily a person will not violate traffic laws unless he is confident that he can get away with it. Otherwise his own self-discipline will keep him out of trouble. Thus, a vigorous enforcement policy will help achieve the goal of real enforcement which is self-enforcement; the citizen will not then need courage to face the music for he will not have committed an offense and there will be no music to face. Under such a system the traffic police will be free to confine their activities to accident prevention and the control of the chronic offender.

SCHOOLS FOR TRAFFIC POLICE—The handling of the traffic problem is a science and an art which needs to be stud-

ied like any other science or art. Schools for the study of traffic control have been carried on in various parts of the country, notably at Evanston, Illinois, under the sponsorship of Northwestern University. A school has been conducted there for a two weeks period each year for the last three years and has been attended by police chiefs, lieutenants, and captains from all parts of the country. The work is partly done in the class room but largely in actual demonstrations on the street. Such schools are greatly needed throughout the country, since at the present time there is little expert knowledge of the science of traffic control among enforcement agencies.

THE COURTS—One of the serious problems before our courts today is overcrowding. Cases often do not come to trial for months or years after they were entered on the docket. The traffic situation is largely responsible for this condition because of the great number of cases of both minor and major importance that have to do with either accidents or traffic law violations. One way to relieve the situation in large cities is by the establishment of special courts to deal with traffic violations. In small cities the cases should be tried by one specially assigned judge.

A still more serious factor in the court situation is the general laxity with which the problem of traffic violations has been handled. The courts of the country cannot be maintained at a higher level than that indicated by the interest and concern shown by the public. The courts must necessarily reflect public opinion and they must depend for their support upon the force of public opinion. The same strengthening of moral purpose in dealing with the traffic problem that is needed in the general public is needed in the courts.

A few outstanding judges with the support of their communities have dealt with the traffic problem in a

highly forceful and intelligent way, and their work has indicated that the courts can play an important role in the control of accidents. When such an attitude becomes more universal we shall begin to make substantial progress in traffic law enforcement.

ENGINEERING

The engineering aspects of the traffic problem have to do with the automobile itself, the construction of the highway and the operation of traffic on the highway, that is, with automotive engineering, highway engineering, and traffic engineering.

AUTOMOTIVE ENGINEERING—There is no question that the modern automobile is a marvel of engineering accomplishment. From a mechanical point of view it is also an unusually safe piece of machinery, although there are certain minor improvements that can still be made. Its chief danger lies in its intrinsic qualities of power and speed. The speed question is outstanding and prompts several inquiries. Have we already exceeded the safe speed at which automobiles can be operated? Must progress now be made by putting governors on cars or otherwise reducing speeds? Or shall our policy be to control speed ourselves? This is a moot question, and no attempt will be made to answer it here, but it is a question which the public must face.

In continuing to build more powerful cars the automobile manufacturers have undoubtedly followed the wishes of the public or at least a considerable part of the public. Nevertheless, it may well be asked whether they should not now, both for the good of the public and the good of their industry, make a serious effort to lead the public away from speed as an important issue. The recent emphasis on safety rather than speed is a significant move

in the right direction. The manufacturers must also endeavor to lead the public away from the type of car in which the driver is seated so deeply beneath the cowl and the radiator that he cannot see the road for many feet ahead. This obstruction to his vision is a serious element of danger. The automobile industry for its own good must maintain leadership in producing a safe car.

HIGHWAY ENGINEERING—Highway engineering until recently was not primarily concerned with safety. There were other problems that had precedence. Recently, however, particularly in the case of super-highway construction, safety has assumed major importance. Undoubtedly, one of the most promising means for bringing the traffic safety problem under control is the construction of super-highways, on which much of the through, swiftly moving traffic can be routed. These can be so constructed that the chances of an accident, for any other reason than downright bad driving, can be reduced to a minimum. This will clear the way for a much more effective enforcement of traffic control, such as for instance in the Holland Tunnel under the Hudson River, where the accidents have been negligible. So far as possible these same good features in the safe construction of highways must be incorporated into highways generally.

TRAFFIC ENGINEERING—The traffic engineer is concerned partly with the design of highways from a safety point of view but even more with the safe operation of traffic on highways and streets. This involves the layout of traffic signals, through streets, stop streets, one-way streets, safety islands and such things, as well as cooperation with enforcement agencies. With the help of the public there are important and effective things that can be done in the traffic engineering field, for obviously there are right and wrong ways to control traffic.

ACCIDENT STATISTICS

Intelligent work on the traffic safety problem, or any other problem, cannot be done without definite and reliable knowledge of conditions. In the case of traffic, information is particularly needed with regard to the causes of accidents and their relative importance, for attention must obviously be directed toward those points at which improvement is most needed and where the most effective results can be had. The collection of reliable and more detailed statistical information is therefore an important factor in traffic accident control.

RESEARCH

Much fuller knowledge is still needed with regard to every aspect of the traffic problem. While tremendous progress can be made on the basis of the knowledge that we already have, we should not be satisfied with a fifty or even a seventy-five per cent reduction in our traffic accidents; but we probably cannot go much beyond such a point without further knowledge. Research must be as much a part of any program for material improvement in traffic control as it is in the improvement of the mechanical basis of our civilization.

COMMUNITY ACTIVITY

In much of the work we have already described it is necessary that the community take an active interest, and in many cases it must actually participate in the movement. Collective organization is, however, particularly essential during the early stages of the program. "Safety Councils" have been operating in many cities for a number of years, and have exerted considerable influence in bringing about better conditions. The most recent efforts have been directed toward organization for traffic safety on a statewide basis, and several states are operating under such a plan with conspicuous success.

AUTOMOBILE INSPECTIONS

While only a small percentage of accidents are reported as due to the condition of the vehicle, it is manifestly desirable and important to keep automobiles that are in dangerous condition off the road and to see that others are kept in good repair. Periodic inspection of motor vehicles is carried on officially by a number of states and cities. No system of traffic control can be thoroughly logical and consistent unless it starts with a provision for the safe condition of the car itself.

ORGANIZATIONS AND TRAFFIC SAFETY

While there is now coming to be a very general interest in the subject of traffic safety there are certain organizations, both governmental and private, that have either been charged with a particular responsibility, or that have assumed it. Some of these are the following:

UNITED STATES BUREAU OF PUBLIC ROADS—The United States Bureau of Public Roads is a division of the Department of Agriculture. It administers the Federal Highway Act. While it has been primarily concerned with the construction and maintenance of highways, the safety features of the task are well within its jurisdiction. With the growing importance of traffic safety this will be an increasingly important feature of its work.

UNITED STATES BUREAU OF STANDARDS—The United States Bureau of Standards has been conducting research and developing standards in the field of safety for many years. Much of its work has had to do with traffic, and much of the research that needs to be done from now on will undoubtedly clear through this organization.

UNITED STATES OFFICE OF EDUCATION—The United States Office of Education in the Department of the Interior has interested itself in safety education for a num-

ber of years. It has published pamphlets for the use of schools and has helped materially to promote and coordinate the safety education activities of the country.

INTERSTATE COMMERCE COMMISSION—The Interstate Commerce Commission, by an act of Congress signed by President Roosevelt on August 9, 1935, was given supervision over all interstate common motor carrier traffic and over interstate contract carrier traffic with certain exceptions. The supervision will be similar in general to that which it has exercised over railroad traffic. The act gives the Commission broad powers with regard to safety of equipment and safety of operation.

The Interstate Commerce Commission has been largely responsible for the remarkable safety accomplishments of the railroads in the last twenty years. While the problem of truck and bus operation is intrinsically more difficult, it is believed that the Interstate Commerce Commission can accomplish parallel results in this field and that the standards which it may be able to set up will, with the cooperation of state authorities, help materially in regularizing automobile traffic in general.

THE NATIONAL CONFERENCE ON STREET AND HIGHWAY SAFETY—The National Conference on Street and Highway Safety was formed in 1924. It is a semi-official organization under the chairmanship of the Secretary of Commerce and is supported partly by the Bureau of Public Roads and partly by organizations interested in the traffic safety problem. It was set up primarily to establish codes and standards that would form the basis for effective traffic control and that would serve so far as possible to put such control on a basis of national uniformity. The work of the National Conference has expressed itself particularly in the following: a Uniform Vehicle Code, a Model Municipal Traffic Ordinance and

a Manual of Uniform Traffic Control Devices. Four conferences have been held in Washington in 1924, 1926, 1930 and 1934. The National Conference has had an important influence on the traffic safety situation.

THE AMERICAN ASSOCIATION OF MOTOR VEHICLE ADMINISTRATORS—This is an association consisting of the officials having charge of automobile traffic in the various states. It has concerned itself, among other things, with the problem of traffic safety and will be influential in coordinating the safety work of the motor vehicle departments and in bringing about uniformity of traffic laws.

THE NATIONAL SAFETY COUNCIL—The National Safety Council was formed in 1912, primarily to deal with the industrial safety situation. It has a Public Safety Division and has played an important part in the development of traffic safety. It serves as a clearing house of information. It compiles statistics of accidents, which are published annually in a pamphlet entitled "Accident Facts." It publishes a number of magazines, including "Public Safety" and "Safety Education." For several years, it has conducted a traffic safety contest among cities. At the present time, some eight hundred cities are enrolled in this contest.

THE AMERICAN AUTOMOBILE ASSOCIATION—The American Automobile Association has, for a number of years, been doing work in the traffic safety field. It and its member clubs are largely responsible for the establishment of school boy patrols.

THE AUTOMOBILE MANUFACTURERS ASSOCIATION—This organization, among its many other interests, is taking an important place in the traffic safety field.

THE NATIONAL BUREAU OF CASUALTY AND SURETY UNDERWRITERS—The conservation of life and limb is a part of the work of the National Bureau of Casualty and

Surety Underwriters, an association of stock casualty insurance companies. It serves as a clearing house of information not only for its own members but for other agencies, and it has taken an active part in the solution of the traffic accident problem, particularly in the development and promotion of safety education in the schools.

THE AMERICAN LEGION—One of the activities of the American Legion has been in the field of traffic safety, and effective work has been done in many localities.

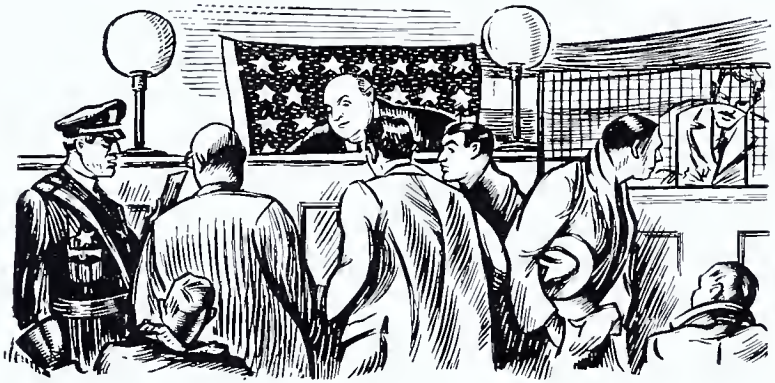
THE NATIONAL CONFERENCE OF PARENTS AND TEACHERS—This organization, with a membership of a million and a half, has an active committee on safety education, has already accomplished much and can be depended upon to be of very real help in getting the schools to take part in this work.

THE DRIVER HIMSELF

We have mentioned in this chapter only a few of the groups which are devoting all or part of their energies to traffic safety. Many others are accomplishing creditable results, but we must now emphasize the fact that the solution of the traffic safety problem cannot be left entirely to organizations. Traffic safety is acutely a personal problem. It directly concerns you and me, partly because it is ourselves, our own families and our own property that are at stake, and partly because organizations can go only a certain distance in solving the problem. In the last analysis, it is what you and I do that is going to determine the results. If traffic is to be made safe, it will because you and I insist on better legislation, better enforcement, better engineering and better education, and because you and I then show our sincerity by becoming better drivers and better citizens ourselves. We are undertaking to make traffic safe. It *can* be done and it *will* be done if *we all* help.

CHAPTER XIV

PAYING FOR ACCIDENTS



An improperly driven motor car can wreck other vehicles, damage property and cause death or serious bodily injury. In 1935, automobiles killed more than thirty-six thousand people, seriously injured nearly a million more, and caused an economic loss of at least one and one-half billion dollars.

This loss must be met in some way. Justice, however, requires that the responsibility for each accident shall be established and that, as far as possible, the persons who were at fault shall be made to pay. When a car is damaged, there are repair bills; when a person is injured, there are doctor's bills and hospital bills. If a working man is injured, he may lose his wages while he is being treated. The loss of an arm, a leg, or an eye may greatly reduce his earning capacity. It is only fair that the responsible person should make what amends he can, by paying for the cost of medical service, for the wage loss, and for any decrease in earning ability.

LIABILITY

This point of view is reflected in the law. Both the English law and the American law require that one whose negligence is responsible for damage must pay for it. In general, he must pay even when the negligence takes the form of a failure to do something that he should have done. In some states, an employer who has neglected to guard dangerous machinery can be made to pay the cost of injuries sustained because of such negligence.

LIABILITY IN THE CASE OF AUTOMOBILE ACCIDENTS—The same principle applies to the actions of motorists. If accidents are caused by their negligence, they are held liable under the law. They can be sued for the cost of repairs and for loss sustained because of bodily injury. The courts will enforce such payment. Passing another car on a curve, or at the crest of a hill, driving too fast for road conditions, driving on the wrong side of the street, violating traffic signals and stop signs, cutting-in, failing to give signals and parking improperly are all actions which indicate presumptive negligence.

LIABILITY OF THE DRIVER—In the case of an accident where a car has been at fault, such liability as there may be will in the majority of cases fall directly upon the driver. He can be sued. If the car is in faulty condition this liability may perhaps be passed on to the owner of the car. If, for example, the headlights are out of adjustment or if the brakes are below a reasonable standard of efficiency this is presumably the fault of the owner and he is in that case guilty of negligence. In the great majority of cases, however, the fault for the accident will lie with the driver himself and he will be held liable under the law.

CONTRIBUTORY NEGLIGENCE—The statements made above must be qualified in an important way. An injured

person cannot expect to collect damages if he was partly to blame for the accident. Pedestrians who are struck crossing against the red lights are partly at fault; they are presumably guilty of contributory negligence. Legally, they have lost their position of advantage and may not be able to force the motorist to pay for their injuries. In the same way, if there is a head-on collision between two cars, each of which had been trying to pass another car near the top of a hill, neither driver can force the other to pay, for each is partly to blame.

THE OWNER IS LIABLE FOR DAMAGE DONE BY HIS CAR— The purpose of suits under the civil law is not to punish the driver but to protect his victims by obtaining payment for the damage done. Whatever may be the liability of the driver himself in the case of an accident, action to secure the payment of damages can also be brought against the owner of the vehicle. A commercial concern, for instance, is legally responsible for the operation of its automobiles by its employees in connection with its business. A man who has been run over by a taxi may sue the company that owns the cab instead of suing the driver. An automobile owner may be held liable for the property damage or bodily injuries caused by the negligence of anyone who uses his automobile with his permission. If the car has been stolen, he may relieve himself of responsibility by reporting that fact to the proper authorities. In all states, motor vehicles must be registered, and must carry license plates. Primarily, this is to make it possible to identify and locate the owner when the car has been involved in an accident or if its driver has violated the law. In individual cases, the responsibility of the owner may appear unfair. For example, a high school girl, using her father's car, had a serious collision. Witnesses agreed that the accident would not have happened if she had been driving at a reasonable speed, and

if the car had not been overcrowded. The victims of the accident sued her father for damages and won awards totalling twenty-five thousand dollars. Her family had to sell its car and its home, and the savings of her parents earned by a lifetime of hard work were wiped out. Someone had to pay the cost of the bad driving. It was less unfair to penalize her family as the owner of the car than to allow the victims of her recklessness to suffer.

In the eyes of the law, any sane person who is committing an illegal act at the time of an accident is presumed to be guilty of negligence. A man who is driving without a license is regarded as responsible for any accident in which he may be involved. The same holds true in states where drivers' licenses are not required if the driver is below the legal age, and his father will probably have to pay for any damage done.

If people are to live together in peace and security, their rights must be amply protected. The doctrine of liability is a stern one. Anyone who undertakes to use a machine with such potentialities for doing damage as the motor car must be made to realize, and must be prepared to assume, the heavy responsibilities that go with such use. The state grants him the privilege, but the privilege carries with it heavy restrictions and responsibilities. No one should own or drive a motor vehicle without realizing what these responsibilities are.

PAYING

If the injured person wins a judgment for damages, the courts will enforce payment. If the defendant has sufficient available funds he may be able to pay without undue pressure on his finances. However, if he does not have the money in cash, he may be forced to sell his home, his automobile and any other of his possessions, except his clothing, household furniture, or the tools

of his trade, if he is a laboring man. A person who has been awarded damages wants his money; and he often needs it badly. The law is inexorable, and will force payment to the last limit of what is possible in a civilized society. If the person responsible for the accident is able to pay, but refuses to do so, he may find himself sent to prison. If the damages cannot be paid in a lump sum, the wages or salary of the person legally liable may be "garnisheed"—that is, the claimant will be given a legal right to a part of the wages. This right will run until the total amount due has been paid.

WHEN AN ACCIDENT OCCURS

Common sense and human decency will prompt a driver immediately to do everything possible in caring for those who have been hurt in an accident. As soon as first aid has been rendered and medical aid summoned, or immediately if no one is injured, the driver should obtain the names and addresses of all witnesses. He should furnish the other driver or injured person with his own name and license number and the registration number of his car. He should make a record of the license number of the other automobile, and the name and license number of its operator, as well as the time and place at which the accident happened. All this information may be needed in the event of a suit for damages. It will also be required for preparing the report of the accident to be sent to the police or the motor vehicle department.

The driver should immediately notify the proper authorities. In most states, failure to report an accident is a violation of the law carrying severe penalties. An attempt to run away from the scene of an accident is generally considered a confession of guilt. This one fact may outweigh all others in determining the jury's verdict. The hit-and-run driver can expect little mercy at the

hands of a judge or jury. He has branded himself by his action as a despicable character.

NOTES TO BE TAKEN ON THE SCENE OF AN ACCIDENT— In their instructions to employees, large trucking concerns tell their drivers that much subsequent trouble may be saved if after an accident happens, the driver neither assumes that he, himself, was to blame, nor accuses another of being negligent. The driver who has been in an accident should not be discourteous, nor should he lose his temper. He has the advantage of the situation, if he keeps cool. As soon as possible after an accident, the driver should prepare for himself a full, true and unbiased account of what happened, making sketches, photographs and measurements of conditions if possible. This will be invaluable in refreshing his memory should he have to testify in court. It is just as important to supply information about minor accidents as major ones. This is necessary to prevent fraudulent or exaggerated claims, since such claims may be made on the slightest pretext.

INSURANCE

Life is full of misfortunes. We try to avoid them, but in spite of our efforts, disasters occur; houses burn, people

die prematurely, automobiles get into accidents and property and lives are destroyed. Insurance is a means of reducing the economic effect of such losses. There are other ways of accomplishing the same result—that is, through ordinary friendliness, or through organized philanthropy.

The friendliness way of dealing with misfortune is somewhat as follows: John Smith's house has burned. Some of his friends get together and say, "Something must be done about John. He has a large family of young children. They must have some place to live and John hasn't the money to build another home. Let's get together and build him one." Exactly this kind of thing happens many times, particularly in primitive communities where needs are simple; and the principle of mutual help is universal.

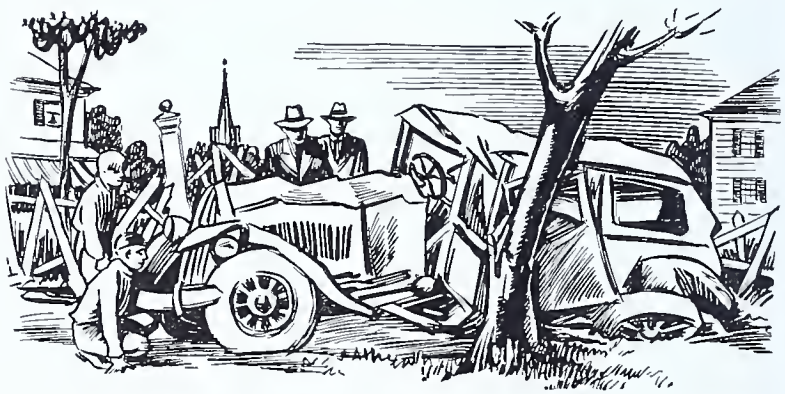
Insurance is only an adaptation of this method through the introduction of one important change. Instead of saying, "*John's* house *has* burned, let us each contribute toward building *him* a new house," suppose John's neighbors got together and said, "The house of *any one* of us *may* burn; let us, *before any house burns,* collect a sum of money to be used in building a house for *the one who happens to have this misfortune.*" That would be insurance in its simplest form. The feature that distinguishes it from philanthropy is that the money is collected before the misfortune has occurred. The misfortune may happen to anyone, so the self-interest of being protected against such an event takes the place of neighborly interest.

The business of insurance is only a method of doing on a large scale and in a more regularized way, what has been indicated above. Neighbors do not have to come together and enter into agreements among each other. Instead, the insurance company acts as an intermediary,

collecting money from those who are exposed to a hazard and distributing it to those who have suffered the misfortune.

THE LAW OF AVERAGES—The insurance company depends upon the working of the law of averages to give its business a substantial basis and to provide uniform rates. While we do not know whether a particular person will live or die, we do know how many deaths will occur on the average. Although we cannot know whether a particular house of a given type, in a particular locality, will burn, we do know the facts about the burning of such houses in general. These averages are dependable, and they form a substantial basis upon which business can be done. In spite of the fact that life insurance is founded upon probabilities, a well-managed life insurance company is one of the most solid and safe financial institutions in the world.

INSURANCE FOR AUTOMOBILE OWNERS—There are various misfortunes that may happen to a motorist. His car may be stolen or destroyed by fire; he, or a member of his



family, may be killed or seriously injured; his automobile may be damaged or destroyed in an accident; he may do damage to the car or property of another and be called

upon to make restitution; or he may kill or injure pedestrians or passengers in another car and be held liable for the damages. Insurance may be had to cover all these misfortunes.

These insurances fall into two quite different groups. A loss may fall directly upon the car owner. Misfortunes of this type are the theft of the car, its injury or destruction by fire or collision, and bodily injury to the owner of the car. The second type of misfortune occurs when the automobile has caused injury to another person or his property and when the owner of the automobile is liable for the payment of damages.

In the first type of insurance only two parties are involved, the owner of the car and the insurer. In the second type of insurance, a third party is involved, namely, the person who sustained the property loss or the bodily injury. This type of insurance is often called "third party insurance."

LIABILITY INSURANCE—Third party insurance may be either bodily injury liability insurance—usually known as "public liability" insurance—or property damage liability insurance. A bodily injury liability insurance policy protects the automobile owner against claims for bodily injury produced by the use of his car. As a practical matter, this means that the insurance company will undertake either to settle the claims or defend them in court if suits are brought. It will pay the judgment if the case is lost, provided the amount called for is not larger than the maximum amount named in the policy. If the total of the court award is larger than the maximum named in the policy, the insurance company will pay the claim up to the amount so named. The most common limits in public liability policies are $5,000 for bodily injury to one person and $10,000 for all bodily injuries to more than one person caused by one accident, but policies with

higher limits can be obtained at an increased price. Property damage liability insurance is handled in a similar way.

It should be clearly understood that bodily injury liability insurance and property damage liability insurance protect the insured, only against claims for damage that his car has done to the person or property of another. These forms of insurance do not protect the owner of a car in case of injury or loss that he may suffer. Such protection can be had, however, through life insurance, health and accident insurance, fire insurance, collision insurance and theft insurance.

COMPULSORY INSURANCE—Liability insurance is a valuable part of our social system. It is highly desirable that definite provision be made so that, if a person sustains an injury or property damage in an accident for which he is not to blame, he may be able to recover his losses. One state, Massachusetts, has made bodily injury liability insurance compulsory, with a minimum of $5,000 for injury to one person and $10,000 for all injuries sustained in one accident. There are practical difficulties, however, that develop in the administration of compulsory systems, and other states have not seen fit to make insurance compulsory—except for trucks and busses.

FINANCIAL RESPONSIBILITY LAWS—Another method of dealing with the situation is through so-called financial responsibility laws, which have been adopted in twenty-six states and in all but one of the provinces of Canada. These laws generally provide that if a person has an accident and does not pay the resulting damages for which he has been held liable, he loses the right to register any automobile he owns, or to drive any vehicle until he pays for the damages done, and furnishes evidence to the state that he has insurance or other financial resources

available to pay for damages in accidents that may occur thereafter. While these laws are primarily designed to encourage the carrying of insurance, they have not been effective in making insurance universal; there are still a considerable proportion of people who do not carry liability insurance.

MAKING RATES

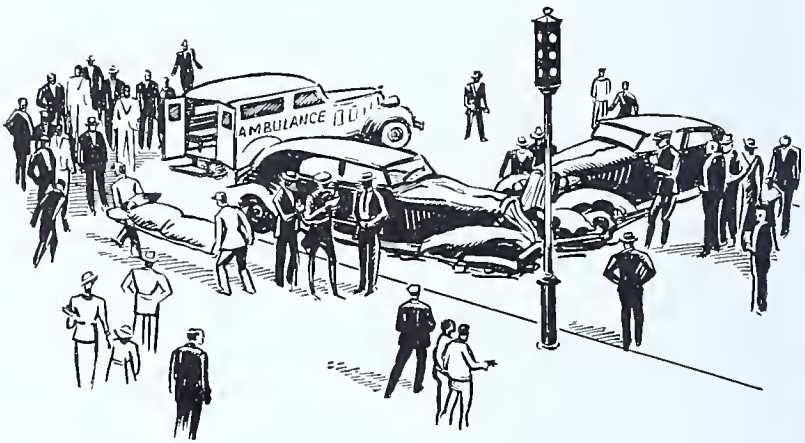
For the most part, liability insurance rates are made by bureaus organized and supported by the insurance companies. Statistics of the amount of insurance written and the losses incurred under such policies are collected and combined and analyzed. These bureaus are under the supervision of state authorities and, in many states, the rates that are made must have their approval.

The "pure premium" rate is obtained by dividing the amount paid out on claims by the number of car-years insured. For instance, let us suppose that 10,000 private passenger cars in New York City have been insured for one year—this is an insurance of 10,000 car-years. Suppose further that among these cars there have been a certain number involved in accidents, and that the total claim cost incurred on such accidents amounted to $440,000. The "pure premium" rate then would be $440,000 divided by 10,000, or $44 per car-year—that is, $44 for one car insured for one year. The actual rate charged is obtained by adding to the pure premium rate a certain percentage to pay for the expense of doing business and for the payment of taxes, commissions to agents and a profit to the insurance company.

It is found that the pure premium rate for private passenger cars varies according to the size and price of the car. Therefore, for rate-making purposes, cars are divided in general into three classes on such a basis.

It is also found that there is a material variation in hazard according to the locality in which the car is used.

There is a considerable difference between the rural sections and the cities; but in addition, there is a large variation among different parts of the country. If a city is large enough, it is rated on its own record. Otherwise, the experience of regions or cities that have essentially similar conditions is combined.



Commercial vehicles are rated separately from passenger cars, on the basis of their own experience, and are divided into classes depending upon the nature of the business, their load-carrying capacity and the locality in which the cars are used.

INSURANCE RATES AND THE PUBLIC—By far the most important and significant observation to be made concerning the rates is that they are made in reality by the public. This statement is true in the following sense: The work of collecting and combining the experience of companies is done by the rate-making bureau, but this work is almost entirely mechanical. The size of the rate depends upon the amount paid out in claims. This, in turn, depends first, upon the number and severity of accidents, and, second, upon the degree of liberality with which cases are treated by judges and juries.

Both of these factors are matters entirely within the control of the community. If a community has the courage and is willing to discipline itself by enforcing its traffic laws and educating its citizens in safe driving habits, and if its judges and juries are fair and moderate in awarding damages, that community can have low insurance rates. On the other hand, if a community has no respect for traffic laws, if it is possible for a driver to evade punishment for traffic violations, and if judges and juries make excessive awards for damages, that community has only itself to thank for its high insurance rates.

FRAUDULENT CLAIMS—One community differs from another, however, not merely in what it does with its accident problem and in what its juries do with the cases coming before them, but in a more sinister way. Insurance in the hands of unscrupulous people can be seriously abused. Claims have been greatly exaggerated; fraudulent claims have been made, and accidents have been faked. In some localities such practices have become a racket with a loot that goes into large figures. The community is the sufferer, because the increased cost is necessarily reflected in the insurance rates. Fraudulent practices can flourish in a community only because they are tolerated. When such a condition exists, the fact becomes well-known. Any community that wants to get rid of fraud has the power to do so. The insurance companies are working to suppress such practices, but they are handicapped without active support by the community.

GUEST CLAIMS—An example of the way in which abuses can affect insurance is the situation with regard to "guest" claims. It is legally possible for a guest of an automobile owner to bring suit against his host for injuries sustained while riding in his host's car. This is something which should in general be ruled out of order through consid-

erations of common decency. But, recently, there has grown up among unscrupulous persons a practice by which—often through collusion between the owner of the car and his guests, where insurance is carried—suits are brought and established, not infrequently by means of fraudulent testimony. Such procedure has resulted in so flagrant an abuse of the intent of the law that in some states laws have been passed making it impossible for a guest to collect unless the driver is guilty of "willful or wanton" negligence. One of the many good reasons why hitch-hikers should not be carried is because suits for damages have been frequently brought by such people.

INSURANCE AS PREVENTION

The primary function of insurance is the collection of money from those who are exposed to a hazard and the distribution of the money so collected to those who have suffered the misfortune. Such a procedure will prevent only the economic effects of the misfortune. Insurance, however, can be made to go a very considerable distance in the direction of preventing the misfortune itself. Because of their ability to pool the premiums of their many policy holders, insurance companies can undertake important work of a preventive nature that would be quite beyond the resources of a single individual. As long as the cost of doing such work is not greater than the economic value of the lives and limbs saved by it, such work is on a sound business basis and can be done with great advantage, both to the insurance companies and to the insured persons. In fact, the "conservational" function of insurance may be as important as its "distributive" function. In steam boiler insurance, for instance, three or four times as large a part of the money taken in is spent on inspections to prevent boilers from explod-

ing as is spent in paying for the explosions when they occur.

The liability insurance companies are carrying on much work of a conservational nature, such as the promotion of safety education, traffic engineering and work with the police on enforcement problems.

CHAPTER XV

THE PEDESTRIAN IN THE AUTOMOBILE AGE

A BITTER war may continue to wage between drivers and pedestrians until we all become better educated to our responsibilities for life in the automobile age. The man on foot holds a smouldering resentment against the man behind the steering wheel largely because he knows that his brittle bones have no more chance against swift moving steel than an eggshell under a steamroller. Meanwhile, the driver keeps a grudge against the pedestrian because he presents such an unpredictable, erratic and helpless hazard to safe driving. Both are treating themselves to the luxury of self-pity, because each has a definite, traceable part in creating the inexcusable number of fatalities and injuries to pedestrians which occur on our streets and highways every year.

For just as witless motorists rocket down our roadways at unreasonable speeds ignoring red lights and traffic signals, so do witless pedestrians step stupidly out into moving streams of traffic from behind parked cars or against the traffic signal light. The result is that nearly one half

of those killed and injured in traffic accidents are pedestrians. Judging by that result it would appear that a pedestrian's handbook "an introduction to the art of walking" would be a best seller.

CAUSES OF PEDESTRIAN ACCIDENTS

Apparently the foot traveler does not realize that in the automobile age he must obey traffic rules just as strictly as the motorist is required to do; he can't hurry through traffic; he can't walk on the wrong side of the road; he can't cross against signals or move where his ability to see traffic conditions isn't perfectly clear. If he does he is not only exposing himself to destruction, but he is placing another motorist in the unhappy position of creating an unwanted and, probably, unavoidable accident.

CROSS ONLY AT INTERSECTIONS—For example, a reliable statistical count showed that while only ten per cent of those afoot tried to cross streets between intersections fully half of those struck by automobiles were crossing in such a manner at the time they were run over. In other words it is five times as dangerous to cross between intersections as at the proper cross walk. Must we wait until ten per cent of all pedestrians are run down by cars before car-pedestrian mishaps between intersections cease? An easier way out would be for every city pedestrian to follow this simple rule: "Cross only at Intersections."

COMING OUT FROM BEHIND PARKED CARS—According to statistics, 35,000 persons are hit by cars every year when they step out from between parked cars. The parked car interferes with a driver's vision and he cannot see the pedestrian until the latter is directly in the path of his moving automobile. Then, it is usually too late to stop or swerve out of the way.

PEDESTRIAN SELF-PROTECTION

TRAFFIC CONTROL SIGNALS—Traffic lights have a dual purpose; they regulate the flow of motor traffic, and are a protection for pedestrians. When the signal says "Go," the pedestrian has the right of way over all motor cars except emergency vehicles. But when it says "Stop," he has no right in the street at all, and out of common courtesy should not attempt to hold up traffic for the few seconds it might take him "to beat the light." In the case of a yellow caution light, the pedestrian as well as the motorist, must appreciate its true significance. The light means that the signal is about to change and that the street should be cleared to permit a change in the flow of cross traffic. In some cities special lights have been put in for the protection of pedestrians, and foot travelers and drivers alike should familiarize themselves with their meaning and act accordingly.

It is well to study the statistical fact that four times as many walkers are struck crossing against the signal light as in crossing with its protection. In exercising their right of way pedestrians should watch out for cars making turns from the right or left.

CROSSING DIAGONALLY—Because the man who tries it is likely to be hit by cars coming from four directions or by cars making eight possible turns, it is strikingly unsafe for him to walk diagonally across an intersection. In some cities the procedure is unlawful. In all, the easiest

way to get diagonally across an intersection protected by traffic lights is to cross one street when the GO signal flashes. Then, after a short wait, until the light changes, cross the second street.

At intersections unprotected by traffic lights, the pedestrian should follow a clockwise path in reaching his diagonal destination. In other words he should first cross the street that will let him make a right turn in crossing the second street. Thus, he will be in no danger from cars making right turns for he will see them before they start.

WALK TO THE LEFT ON RURAL HIGHWAYS—Throughout the country thousands and thousands of miles of highway are still unprovided with sidewalks or side paths for pedestrians. Often foot travelers cannot use the shoulder of the road either because it is too rough, because it is muddy in wet weather, or because it is not wide enough to provide satisfactory protection. In consequence, the pedestrian is almost forced to walk on the highway, and the best way to protect himself from motor traffic is by walking to the left so that he faces oncoming cars. Then, he can see oncoming traffic, and step off the road, if necessary, as it approaches. He runs little risk of being struck down from behind.

DANGERS AT NIGHT—Pedestrians walking on rural highways at night should take extreme care. Visibility for the motorist is extremely low, and often he does not see the man on foot until he is only a few feet away from the car. There is more danger if the walker is wearing dark clothing, if the highway surface is dark, or if two cars meet just as they come alongside of a pedestrian, in which case the driver is likely to be blinded by the glare from the passing car, and in making way for it he may get off the road.

Clever pedestrians not only walk to the left at night,

but make sure that some part of their clothing is sufficiently light to present a contrast against the darkness. If it is impossible to wear a light piece of clothing, they carry a handkerchief, a lighted lantern or a flashlight.

PEDESTRIANISM IN BAD WEATHER—Pedestrians must remember that a driver's ability to see ahead is poorer and his stopping distances greater in bad weather. In the rain or snow, or on a wet or icy street, the pedestrian who attempts to take chances by darting in front of automobiles is just being silly. Either he may slip and fall in front of an oncoming car, or in trying to avoid him, the car may skid out of control. The best procedure for pedestrians is to keep alert, and move across streets or along roads only when the path is completely clear.

BUNDLES AND UMBRELLAS—Persons carrying umbrellas or large bundles and packages should be careful not to obstruct their own view of the road. Otherwise, they are in danger of being hit by a vehicle they may not see.

GETTING OFF A BUS OR STREET CAR—In dismounting from a bus or street car, the smart pedestrian looks back down the road to see that no traffic is coming, and then walks directly to the nearest curb. He knows in many cities that an ordinance requires traffic to stop and permit him to reach the sidewalk in safety. But, like the good driver, he does not depend entirely on other people remembering the rules; *he sees for himself.* Under no circumstances does he move in front of the bus or car to cross in front of traffic coming from the opposite direction. He waits on the curb until traffic is clear or until the signal light permits him to make the maneuver.

WAITING FOR A STREET CAR OR BUS—The smart pedestrian waits as long as possible on the sidewalk at the curb for his street car or bus to appear, even though safety

aisles may be provided in the middle of the street. He realizes there is no point in exposing himself to two moving streams of traffic or to the exhaust fumes they create or the mud and water they may splash.

SAFETY ZONES—Some safety zones are islands protected by curbs or strong, permanent supports; others are merely marked by white lines or by metallic buttons in the pavement. Some are protected by traffic control signals which should be obeyed to the letter.

CONFUSED SITUATIONS—Occasionally a pedestrian may find himself in the center of moving traffic where both he and the motorists are in danger of becoming confused. He must then display calmness and presence of mind, for if he loses his head and darts first in one direction and then in another the possibility of his being hit is immeasurably increased. If he moves backward drivers will attempt to steer in front of him. If then he suddenly darts forward, he places himself directly in the path of a car that otherwise would have avoided him.

In situations of this kind, the smart pedestrian will stand still, permitting drivers to move easily about him without having to guess what his next move may be. Or if the occasion is critical, he may hold up his hand, and good drivers will stop to permit him to cross safely to the nearest curb.

KEEP TO THE RIGHT—The "Keep to the Right" rule which is imperative to motorists is also an effective rule for pedestrians at crowded street crossings. In larger cities it is common to see two large groups start across an intersection only to become hopelessly tangled when they meet in the middle. If each group kept to the right, passage across the street would be quicker.

WALK, DON'T RUN—In general, streets should be crossed at a walking pace. Running not only confuses the mo-

torist but makes it very difficult for the pedestrian to keep track of the motorist's movements and intentions.

THE STREETS AS PLAYGROUNDS

One of the worst features of the automobile age is the danger to which young children are exposed, especially in those communities which have failed to provide adequate and suitable playground space. Children must play, and if they are forced into the street because of cramped quarters, it is every driver's duty to protect them. Children playing games concentrate whole heartedly on their play, giving little attention to approaching automobiles in spite of earnest efforts to teach them safer practices. Consequently, the responsibility for their safety rests with the driver—who after all was once a kid himself.

COASTING—Winter sledding should take place only on hills where no street intersections interfere or where the streets have been specially closed to traffic for the sport.

We must remember that sleds can be used only at a time when the going is the worst for automobiles, that cars have the greatest difficulty in stopping on snowy or icy

surfaces. Good drivers keep away from coasting areas as far as possible. There are an appalling number of accidents every winter caused by coasters running into cars.

ROLLER SKATING—At certain seasons of the year, usually fall and spring, drivers must be especially alert for unusual numbers of roller skaters. On the other hand skaters must be aware of cars, and must never hitch rides.

BICYCLES—A bicycle should be looked upon as a vehicle that must obey all the rules laid down for vehicular traffic. Cyclists must stay to the right, and on heavily traveled streets ride in single file instead of abreast. A good cyclist avoids congested areas; if he is stopped by a traffic light, he dismounts until it changes.

THE RESPONSIBILITY OF THE MOTORIST

Good drivers, realizing the mobility of the pedestrian, are not surprised to come upon him in unusual places. They understand that it is their duty to protect foot travelers, for they know that any collision between a car and a person on foot is grossly unfair. The driver is protected by his heavy car; the pedestrian is defenseless. Moreover, considering the speed of modern cars, human agility is of small use in dodging from the path of a fast automobile.

BULLDOZING PEDESTRIANS—At unguarded intersections pedestrians have the right of way, and the right should be respected by all drivers. Occasionally, one will encounter the bully type of motorist who knows that no human being wants to be hit by a car, and who, therefore, takes advantage of his safe position by bulldozing. He drives rapidly up to the intersection, blows his horn madly and laughs to see pedestrians scamper from his path. Sooner or later he may find himself responsible for running down a child, or an aged and feeble old man or woman.

USING THE HORN—With pedestrians, the horn is properly used in two situations. To warn a group of children

playing in the street of the approach of his car the good driver slows down perceptibly and gets ready for an emergency stop; then he blows his horn to give the children warning to clear the road. Again if a pedestrian is walking along a road with his back to the car, the good driver gives a gentle toot to signify his intention to pass.

The obligation of the driver toward the pedestrian is even recognized in laws which give the motorist certain rights of way over the foot traveler. Such laws usually conclude with the statement "This provision shall not relieve the driver of a vehicle from the duty to exercise due care for the safety of pedestrians."

THE RESPONSIBILITY OF THE COMMUNITY

Cities and towns supply their citizens and residents with police and fire protection because they appreciate their responsibility for conserving life and property. Similarly, they must soon come to the rescue of drivers and pedestrians. For example, they cannot much longer neglect to safeguard children by failing to supply adequate and suitable playground space in order to minimize playing in the street. They must soon build footpaths along rural highways in order to protect pedestrians who must now expose themselves to the hazards of walking on the highway. They must build sturdy well protected safety zones to prevent accidents to persons waiting for street cars and buses.

Already some forward looking cities have begun the work. Some have built pedestrian tunnels or bridges at major intersections so that the man on foot can cross the street in complete absence of danger. Some are using mid-intersection islands so that in crossing a street the pedestrian needs to watch traffic approaching from only one direction. As a result of the current enthusiasm for

accident prevention it is likely that much more attention will be paid to engineering of this kind.

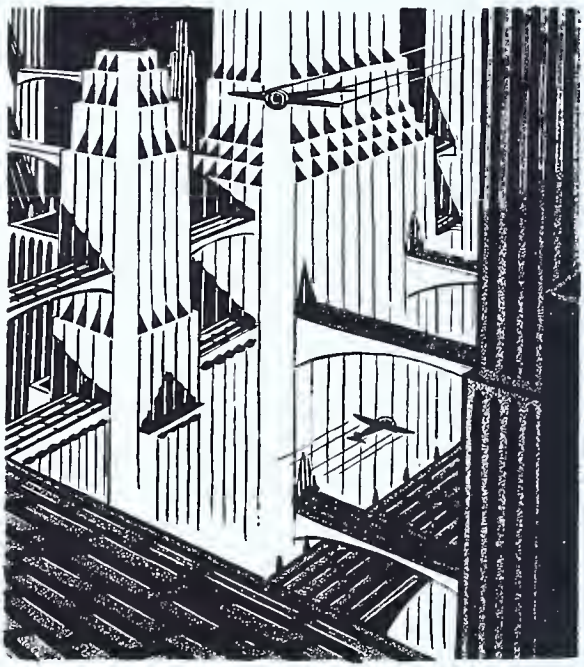
REGULATION OF PEDESTRIAN TRAFFIC—The persistent violation of traffic rules by great numbers of pedestrians who "get away with it" because they are on foot, indicates the need for cleverer pedestrian laws and stricter enforcement. Cities are beginning to enforce laws directed at the driver; they must soon turn their attention to those governing the pedestrian.

Some communities have been successful in regulating the flow of pedestrian traffic through intelligent legislation and more rigid enforcement. For example, the man on foot who tries to beat the red light, is arrested and fined just as summarily and on the same basis as if he were a driver. To achieve this success, these communities have needed the active support of public opinion.

When America was a wilderness the threat of wild beasts and hostile Indians was a more complicated pedestrian problem to frontiersmen and explorers than the automobile is to man today. Those who survived in that adventurous era did so because they concentrated their energies on adjusting themselves to the hazards and conditions of their environment. They were alert; they learned to walk noiselessly, to interpret each favorable and forbidding sign to their own advantage. Thus, if the pedestrian of today is not to become too literally "The Vanishing American," he must adjust himself to his environment. The automobile is everywhere; its numbers will probably increase rather than diminish, and the wisest man on foot will be the one who does not depend upon the driver for his own personal safety. The question is not now one for moral dispute; it rests clearly on the issue of whether the individual wishes to remain alive and unhurt. If he does, he will do his personal share in solving the pedestrian problem.

CHAPTER XVI

THE AUTOMOBILE MILLENNIUM



In bringing a book of this kind to a conclusion, a book that has been so largely concerned with the way things *ought* to be rather than the way they *are,* it is permissible to look into the future in order to see what results such a righting of conditions will produce and what kind of a world we are headed for. These conclusions are put in the form of prophesy, with the question left open of how quickly and completely such conditions can be realized.

In the process of gaining a place for itself in the history of civilization that might be dignified with the name of an

"era," the automobile has encountered a series of major obstacles. In the beginning the difficulties were mechanical: it was a question whether there could be such a thing as an "automobile." There were not only a multitude of details to be worked out but when the various mechanisms had been invented and assembled there was still the question of whether the thing would go, whether it would not rattle itself to pieces after a few miles and hours of operation.

The pioneers received little encouragement; to most people motor transportation for the masses seemed preposterous. Today, however, we have an automobile that for its mechanical effectiveness, its dependability, its comfort and its luxury might well astonish Nichola Cugnot, Oliver Evans, Charles Duryea or any other of the early discoverers in this field. Tomorrow, we too may be astonished in our turn at what engineers have done to improve the automobiles of today.

After getting past its early mechanical difficulties, the motor car met another mountainous obstruction in the problem of streets and highways. The science of highway engineering was in its infancy. Furthermore, people knew that good roads would cost enormous sums of money, and they were not yet convinced that the automobile was to have a permanent and important place in our national life. Public opinion thriftily objected to plunging into debt for roads, with the result that our highway system has been continuously underdeveloped in comparison with our needs. Even today, though we probably have the best highways in the world, many thousands of miles of road are quite inadequate for the traffic that uses them.

Nevertheless, even in their present state, our highways are what have made possible the giant size of our motor traffic and the tremendously increased cruising range of our automobiles. They have now in turn brought us

face to face with the third, and possibly the most serious and perplexing problem that threatens the glory of the automobile age,—the scourge of motor accidents.

It will be the experience that we have gained in our struggle with these three obstacles that will fit us to live in the automobile age of the future, an era that will see fast transportation over superb highways, a minimum of accidents and easy mobility for all. Before we can realize this ideal, however, we have a major choice to make. One fork in the road, the more difficult one, leads us into this promised land; the other, the easier way, may eventually lead us back to an era when most of us will be able to move only upon our two feet.

If we take the latter course, we are probably in for a period of sharp and arbitrary regulation of motor car rights and privileges. If you violate a law or have an accident, your privilege to own or operate an automobile may be taken away from you forever, notwithstanding the fact that society has not discharged its own responsibilities by teaching you how to drive or by providing you with a thoroughly safe road or by insisting that you have a thoroughly safe car. You may have a restricted license issued to you, saying that you may operate your car only every third Sunday or only on Monday and Thursday of each week. You may be ordered to use mechanical devices that will govern the maximum speed at which you may drive. In a frantic attempt to reduce death and injury on the highway, any one of dozens of drastic measures may be put into effect that will kill the pleasure and curb the natural liberty of citizens who want to move in motor cars. Under such conditions, the use of automobiles will manifestly decline.

On the other hand, if we face our problem seriously, courageously and intelligently we shall enter into a period where those who drive will be skillful and cautious, where

automobile manufacturers, builders of highways, law enforcement officials and the motoring public will be all working together to carry on a successful, well-regulated enterprise.

THE AUTOMOBILE

What can we expect to find in the automobile of the future? We could have, if we desired it, greater speed, but we probably have already all the speed that we should be allowed to use. As Sir Malcolm Campbell has said, high speeds are for the race track and not for the highway. We can certainly look for increased safety, comfort and dependability. We can expect better and more effective brakes, tires that are blowout proof and that are better able to be used on slippery surfaces, and we may perhaps have some fundamental redesign of the car that will make it roomier, more convenient and safer. We can anticipate increased riding comfort in a variety of ways, through such things for instance as improved ventilating systems and possibly even air conditioning. We can undoubtedly expect some marked improvement in the efficiency of the motor as measured in gas consumption, and we shall see still further improvement in fuels.

THE HIGHWAY

Perhaps the most spectacular developments in the automobile age of the future will be on our highways. Engineers are convinced that highways can be made virtually accident proof for the *good* driver. They plan to span the United States with a network of superhighways that for all practical purposes will be straight as the flight of an arrow. Whatever curves may be necessary will be so long and well banked as not to appear like curves at all. On these highways there will be no such thing as intersections, no need for regulating speed through congested areas and no possibilities of head-on collisions.

All traffic on main highways will travel at speeds definitely regulated by lane restrictions. Turns will be made only to the right and the pedestrian will not have to endanger himself in moving traffic; walkways will be provided for him at the side, and he will be able to cross highways through tunnels or on overhead bridges.

Through traffic may be carried through cities on overhead or underground highways. It is possible that heavy commercial traffic will disappear from the city streets, goods being delivered to the basement of stores through underground arteries. The parking problem may be solved by the use of multifloor garages or in other ways.

Highways will be built for pleasure, for beauty and for scenic purposes as well as for business use. These pleasure trails will lead to the seashore, to mountains, lakes and woodlands, and they will be adequate to accommodate the heavy week-end and vacation traffic. We shall no longer be afraid of Sunday driving. The beautiful spots in the United States, in Canada and even in Alaska and in Central and South America will become accessible. All along the way, hotels, taverns and camps will provide the traveler with the comforts of life. Such freedom of travel will not only contribute directly to our pleasure and happiness but it will help to break down sectional and national differences.

Our highways of the future will not only get us to places where we want to go but they will get us there in the most delightful way, through beautiful country and over beautifully planned and kept parkways where motoring will be a joy in itself as well as a means of reaching our destination.

TRAFFIC CONTROL

Traffic laws will be not only wise and adequate but uniform. The motorist will no longer be confused by con-

flicting regulations in the various parts of the country. He will know what is expected of him, and he will run no danger of innocently violating the law. The need for laws on the modern highways will be much simplified, however, because of improved construction; questions of right of way, restrictions on passing, regulations governing turns will largely disappear because they will not be needed. The driver will find it easier to concentrate on the few, essential conditions of good driving that will remain.

Police supervision will be adequate, strict, and impartial. Through greatly amplified motor patrols and the increased use of radio, the highways will be vigilantly policed by men thoroughly trained for the job. There will be corresponding improvements in the mechanical part of our control system, such as signalling devices.

Not only will there be a more adequate and watchful policing of the highways but when an offender is arrested, punishment will be swift and sure. Ticket fixing, and even to a considerable extent the ticket system itself, will not only become obsolete but judges, supported by the force of public opinion, will deal with offenders with a severity befitting the serious nature of the offense.

THE MOTORIST

In the automobile millennium, however, it is the driver who will still be in the center of the picture. We can admittedly take care of the traffic situation only partially through superhighway construction. However many of such highways we may build, there will still always remain a multitude of minor roads and lanes as well as the larger proportion of city streets in which mechanical safeguarding and construction will play a minor role. Thanks be we shall continue to have these little roads and lanes, for here, rather than on the superhighway, is where we shall get the true flavor of the country.

We come back then to the motorist himself. It is to him that we shall look in making our traffic safe. What may we expect of the motorist of the future? He will be a far different creature from the driver of today; he will belong to a new race. Driving will be viewed not as a right but as a privilege to be given, after the most rigorous and careful examination, only to those who have demonstrated that they are physically and mentally and morally and by training and aptitude capable of assuming such a responsibility. We shall find a considerable proportion of persons who will not have these qualifications. Not only will people who are physically incapacitated not be allowed to drive, but also persons who lack judgment and a social conscience,—the type of person that becomes for example the "hit and run" driver. A person who has had an accident or who has seriously violated the law will be subjected to careful scrutiny and reexamination before being allowed to recover his privileges.

Another class of drivers will be weeded out, the accident-prone drivers. Any of these who are employed and who prove to be incapable of reeducation will have to find occupation in fields for which they are better fitted.

The driver of the future will not only be carefully

selected to find out whether he has the natural qualifications for driving, but he will be carefully trained, and his education in driving will come at the beginning of his driving career and not in the form of a reeducation.

The automobile has become an integral part of our civilization, and driving has become an intrinsic part of our life. It has the same relationship to our life that woodcraft had to the life of the Indian. Just as it was essential that the Indian should know how to traverse the woods skillfully and safely so it is equally necessary that we should know how to traverse our streets and highways skillfully and safely. It is only by the development of such an ability and the restriction of the use of the automobile to those who have developed such an ability that the use of the automobile can be tolerated. The motorist of the future will have these skills!

THE PUBLIC

And finally what may we expect of the public, for it is the public in the last analysis that will control the situation? The public of the future will not be the tolerant, easy-going public of today. It will be a public that is more conscious of its rights and more insistent on having them. It will be a public that not only sees visions but that translates its visions into realities. It will be a public that sees that the automobile must and can be controlled. It is to such a public that we must look for the moral purpose and determination that will bring the automobile into its proper place in the world.

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Delaware	Minnesota	Vermont
District of Columbia	New Hampshire	Virginia
Indiana	New Jersey	

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QUESTIONS

Chapter I

1 Which one of the following was used to run the very first automobiles?

a Steam b Gasoline c Electricity d Benzine

2 In what ways is the automobile more convenient than the railroad train?

3 Why has the gasoline automobile gradually taken the place of electric and steam driven cars?

4 Is it a good description to speak of the first motor cars as horseless carriages? Explain your answer.

5 How were automobile engines started before self-starters were invented? What were the disadvantages of that method?

6 Why did the first motorists wear such queer costumes?

7 Name two important troubles arising from use of the automobile today.

8 About how many automobiles are now being used in the United States?

a 10,000,000 b 25,000,000 c 50,000,000 d 100,000,000

9 About how many men are employed directly and indirectly by the automobile industry?

a 4,000 b 40,000 c 400,000 d 4,000,000

10 Which of the following statements are wrong? Why?

a Modern tires are more dependable than early tires.
b In 1900 almost all roads were built of concrete.
c An automobile named Orukter Amphibolis won the race at the Chicago World's Fair in 1893.
d Gasoline used to be sold in hardware stores.
e The first steam automobiles had iron tires.
f The first gasoline automobile was invented by Nichola Cugnot.
g It was hard to change tires on early cars.

(Several notable collections of early automobiles are to be found in the United States. One is at the Smithsonian Institute, at Washington, and another, at Dearborn, Michigan.)

Chapter II

1 Why do good drivers take care to engage the clutch slowly?

2 Tell how automobile engines are cooled.

3 Describe the four strokes of a piston, and tell what happens on each stroke.

4 Why do automobiles have gears?

5 What is it that brakes do?

6 If the oiling system of an automobile engine went out of order, what would happen?

7 How is the speed of an automobile engine controlled?

8 How is an automobile engine started?

9 What is the spark plug for?

10 What does the distributor do?

Chapter III

1 Describe in detail every action a driver should take from the time he enters a parked car until he has the car in full motion.

2 Tell how a good driver stops his car.

3 Name three driving errors which may cause a car to stall. What is the correct thing to do in each case?

4 Describe how to park a car in a narrow space.

5 Explain one method of starting a car on a hill, without allowing it to roll backwards.

6 If brakes will stop a car going 30 miles an hour in 50 feet, how far will it take them to stop the car going 60 miles per hour?

a 50 feet b 100 feet c 150 feet d 200 feet

7 What is the best thing to do when parking a car on a steep hill, facing downhill?

a Turn the front wheels toward the curb.
b Keep the wheels pointed straight ahead.

c Turn the front wheels away from the curb.
d Pull out the hand throttle.

8 What is the best way to get out of a skid?

a Use the brakes.
b Disengage the clutch.
c Steer in the direction of the sideways motion.
d Turn off the ignition and use the emergency brake.

9 Is it easy to get a car out of a skid at high speed? Explain your answer.

10 Coasting is a bad driving practice because:

a The car is likely to go into a skid.
b The brakes alone may not be able to stop the car as quickly as may be necessary.
c The engine may stall and the driver may not be able to start it in time to start uphill.
d The steering wheel may break.

Chapter IV

1 What is meant by reaction time?

2 How does a driver form good habits?

3 What is carbon monoxide? What is its effect upon drivers?

4 What is meant by the statement, "Gasoline and alcohol do not mix"?

5 What are prepared decisions? How do they help drivers?

6 How can a driver discover his bad habits?

7 What is color-blindness?

8 Why do young drivers have more accidents than older people?

9 Are women drivers worse than men? Explain your answer.

10 Which of the following statements are wrong? Why?

a A driver who has had only a few drinks is just as dangerous as one who is obviously drunk.
b People with "tunnel vision" cannot see objects coming toward them from the side.

c Fifteen per cent of the drivers are to blame for the majority of all automobile accidents.
d Most drivers do not know what their bad habits are.
e Drunken drivers usually realize that they must be very careful.
f Carbon monoxide is dangerous to drivers only in garages.
g The average driver starts applying the brakes at the exact instant he sees danger ahead.
h The driver who can think quickly is a safer driver than the one who has many prepared decisions.

Chapter V

1 What are the dangers of using radio sets in automobiles? When may radio sets help the driver? Give your own opinion, with reasons, as to whether automobile radio sets are good or bad.

2 If you were asked to make up an examination which people must pass before they could get driver's licenses, what kinds of tests would you put in the examination? Why?

3 Describe three accidents which might happen to a driver who is not paying attention. You can make these up: they do not have to be real accidents.

4 What is automatic driving? What is its danger?

5 Why is one-arm driving illegal in many states? Explain your answer.

6 Describe one way in which a driver can help himself to stay awake on a long trip.

7 What would you do if you were driving fast along a country road and a bee flew in the car? Why?

8 You are driving in strange parts of the country and come to a place where two roads cross. There are a great many signs telling which roads to take to reach certain towns and cities. What is the proper thing to do?

a Go straight ahead and then ask someone if you are on the right road.
b Look at the signs as you pass them and then turn into the correct road without slowing down.
c Look at the signs as you pass them, but be careful to slow down if you have to make a turn.
d Stop the car at the side of the road and read the signs.

9 You are driving along a curving road and the car ahead is going very slowly. What is the best thing to do?

a Blow your horn.
b Slow down and drive far behind the other car.
c Slow down and drive as near the other car as you can.
d Pass the other car, even though the road is curving.

10 Which of the following statements is wrong? Why?

a Drivers who go fast are better than drivers who go slow.
b Drivers who are in a hurry tire themselves.
c Road hogs are people who insist on breaking speed laws.
d Show-offs are usually better drivers than other people.
e Some drivers try to break records because they are bored with motoring.
f In some states any person, even a lunatic, may legally drive an automobile.

Chapter VI

1 Using a road map, describe two routes by which a driver could go from your school to a city at least two hundred miles away.

2 What is the meaning of the red light in traffic signals? The green light? The yellow one?

3 What warning signs are placed near railroad grade crossings?

4 What is a "stop" street? How are drivers expected to act when they approach a "Through" street or an express highway?

5 What is a traffic circle? How should it be used by drivers?

6 Why are cloverleaf intersections built? Describe how to make what would ordinarily be a right turn and a left turn.

7 Why are curves banked?

8 Describe how to pass another car on a four-lane road.

9 Name four types of accidents and tell how engineers try to prevent each type on "super-highways."

10 Which of the following statements are wrong? Why?

a The Bureau of Public Roads helps the states to build highways.
b Roads were once so poor that they were dangerous for bicycle riders.

c Automobiles are more likely to skid on dirt roads than on concrete or asphalt.
d The small grooves on the surface of a concrete road are caused by carelessness, and road-builders try to make the surface as smooth as possible.
e The center lane of a three-lane road is for passing on curves.
f It is safer to pass another car near the top of a hill than near the bottom.
g In one-fourth of the collisions between automobiles and trains the automobile ran into the train.
h A good driver pays no attention to signs; they are meant for beginners.
i Centrifugal force is another name for the force of gravity that pushes a car towards the inside of a banked turn.

Chapter VII

1 What are the two theories as to the way in which speed laws should be written? What are the advantages of each? What compromise is often made?

2 Describe three hand signals commonly used in your locality. When should they be used? Why?

3 Are traffic rules the same throughout the United States? Is this a good thing?

4 Can a driver in city traffic save much time by such bad driving practices as cutting-in and beating the lights?

5 What is cutting-in? Why is it dangerous?

6 What is the first thing to do after an accident?

7 Why do we have traffic laws?

8 When should a driver blow his horn?

a When he must warn a pedestrian.
b When there is a traffic jam.
c When he wants the car ahead to go faster.
d When he must back his car.

9 Which is the best thing to do when you hear the siren of a fire truck?

a Wait for it to pass you and then race behind it.
b Drive to the other side of the street and stop.

c Drive as near to the right side as you can and then stop.
d Make a right turn at the next corner.

10 Which of the following statements are wrong? Why?

a A parked car cannot be a source of danger.
b If a street car stops to let off passengers you should pass it on the left.
c Good drivers try to drive more slowly than other cars using the same road.
d Beating traffic lights is legal if you blow your horn.
e It is illegal to pass another car going in the same direction by going to the right.
f It is wrong to drive along the left side of a country road.
g On a rural road it is usually illegal to park your car on the traveled part of the highway.

(*In case of doubt as to the answers of any of these questions, consult the Motor Vehicle Regulations of your state.*)

Chapter VIII

1 Why are blow-outs more dangerous at high speed than at low speed?

2 What is the difference between a spectacular driver and a good driver?

3 What is the best thing to do when driving down a steep hill?

4 What is meant by "assured clear distance ahead"?

5 Is it cheaper to drive at sixty miles an hour than at thirty? Why?

6 What is a "factor of safety"?

7 Why is backing likely to be dangerous?

8 Why do brakes wear out more quickly on some cars than on others of the same make?

9 When are drivers likely to think they are going more slowly than actually is the case? What is the danger of this?

10 Why do good drivers shift into second when rounding a corner where traffic is heavy?

11 When the speed of a car is doubled, by how much is the stopping distance increased?

Chapter IX

1 Describe special driving precautions necessary when driving in a fog.

2 What is the difference between rough ice and glare ice? Which is the more dangerous? Why?

3 Why does headlight glare produce temporary blindness? What can drivers do to prevent this?

4 What happens when the wheels "lock"? What can be done to prevent this?

5 Describe the best method of approaching a curve when the road is covered with ice.

6 When warming an engine in cold weather, is "racing" it the best procedure? Explain your answer.

7 What is the proper method of stopping a car when the road is slippery?

8 What dangers arise when the shoulder of a road becomes slippery?

9 Why does rainy weather require special caution in driving?

10 Why has it been made illegal in many states to drive a car at night with but one headlight burning?

11 What advice can you give about starting a car on icy pavement?

Chapter X

1 What is meant by "driving ahead"? Give an example.

2 Does a good driver try to pass another car which is going through an intersection? Why?

3 Describe how to make a correct right turn.

4 Describe how to make a correct left turn.

5 Name two kinds of accidents which may be caused by a driver who tries to pass another car when he does not have enough space to do so safely.

6 How may the driver of an overtaken car aid in reducing the danger of an accident?

7 Is it safe to violate a rule of good driving even once? Explain your answer.

8 Describe two ways in which a poor driver may be quickly recognized.

Chapter XI

1 What is the advantage of having cars inspected regularly twice a year?

2 Why is it important that the dials on the instrument board be made so that they can be read at a glance?

3 What simple test could you use to determine the condition of brakes?

4 How does one get the maximum service out of tires?

5 Discuss what is meant by the statement, "The headlight situation today is chaotic." What can be done to improve upon this situation?

6 Why is safety glass being used as standard equipment on most new cars?

7 What precautions would you use in "breaking in" a new car?

8 Which of the following statements are false? Why?

a Salt solutions make desirable anti-freeze mixtures.
b A lighter oil is required for lubrication in the winter than in summer.
c Oil filters do not require replacement during the life of a car.
d "Knocking" occurs when the spark is too advanced.
e A lean carburetor mixture burns too much gasoline.
f Heavy blue exhaust smoke indicates an excessive use of oil.
g Three out of four cars were found by state inspectors to be defective in at least one piece of safety equipment.

Chapter XII

1 Into what three general classes can the causes of traffic accidents be divided?

2 Do mechanical defects of the vehicle contribute to a majority of traffic accidents?

3 How do most people learn to drive? Do we need a better system? Explain your answer.

4 What are the three most serious faults on the part of pedestrians that result in accidents?

5 The autumn months are the most dangerous ones. How can you account for this?

6 Why is driver training so needed in the high schools?

7 One person is killed in an automobile accident

a Every fifteen minutes.
b Every half hour.
c Every hour.
d Every day.

8 One person is seriously injured in an automobile accident

a Every half minute.
b Every minute.
c Every fifteen minutes.
d Every half hour.

9 Which of the following statements are false?

a The economic loss from motor accidents is less than the annual loss from fire.
b In a family of three children, one child will be killed or injured in a normal lifetime.
c More emphasis has been placed upon the control of pedestrians than drivers.
d The greatest number of drivers who have accidents are physically defective or ignorant of traffic rules.
e Fatal accidents are most numerous from six P.M. to six A.M.

Chapter XIII

1 Why have people allowed the accident situation to become so bad? What is being done to change this?

2 The National Conference on Street and Highway Safety has prepared codes on traffic regulations. Why are these needed?

3 What happens in a community where it is easy to have tickets "fixed"? What can be done about this situation?

4 Describe the work done by school boy patrols. Has this had any effect?

5 Do you think that the high schools should teach young people how to drive? Explain your answer.

6 Describe three things that your own city or town could do to reduce traffic accidents.

7 Will safety slow up traffic? Explain your answer.

8 Name three bureaus of the Federal Government which are concerned with the prevention of automobile accidents.

9 Which of the following statements are right and which are wrong? Why?

a Elementary school children have had a greater improvement in their accident record than older people.

b The worst drivers on the road are the men who drive commercial vehicles.

c Better training of police officers is one way of helping reduce accidents.

d Modern automobiles are not as safe in construction as those of ten years ago.

e Special courts are needed to take care of traffic violations.

f The National Safety Council conducts traffic safety contests among cities.

g There is no real need for drivers license laws.

Chapter XIV

1 What information should you obtain from another driver when your car has been in a collision with his?

2 What is meant by negligence?

3 What is meant by contributory negligence?

4 Name three driving errors that might be considered as negligent.

5 What is the purpose of insurance?

6 What is liability insurance?

7 What are financial responsibility laws?

8 Which of the following statements are right and which wrong? Why?

a The owner of a car is responsible for damage done by his car only when he is driving.

b The owner of a car is responsible for damage done by his automobile only when a licensed driver is using it.

c Unless he has notified the police that his car has been stolen, an automobile owner is responsible for all damage done by negligent use of his car.

d It is easy to avoid paying for damages caused by negligent use of an automobile.
e Insurance companies spend money on preventing accidents.
f For a driver to run away from the scene of an accident is usually regarded as a confession of guilt.
g Minor accidents should be reported to the proper authorities.

Chapter XV

1 What are the three most common causes of pedestrian accidents?

2 What are various cities and states doing to reduce these accidents?

3 How can we provide greater safety for pedestrians on rural highways?

4 Describe what can be done by a community to provide safe coasting and roller skating.

5 What suggestions could you offer to make bicycle riding safer?

6 In spite of the safety instruction in schools, children still play on the streets. How do you account for this?

7 The following pedestrian practices are dangerous. Explain why.

a Walking diagonally across an intersection.
b Walking on the right side of a rural highway.
c Crossing the street between intersections.

QUESTIONS AND ANSWERS EVERY PENNSYLVANIA MOTORIST SHOULD KNOW

1. May any sign or poster be displayed on windshield or rear or side windows?
   A. No. Nothing except official inspection sticker.
2. What must you do on approaching a traffic signal lamp which is flashing red intermittently?
   A. Come to a full stop and observe approach of other traffic carefully before entering intersection.
3. Can the equipment on your vehicle fail to comply with the law even though the motor vehicle has been inspected by an official inspection station?
   A. Yes. Equipment which is satisfactory at the time of inspection may become defective quickly owing to some unforeseen condition.
   Examples
   a. Oil or water on brake drum
   b. Burned out lamp bulbs
   c. "Shimmy" caused by blowout patch on front tire.
4. Mention two occasions when the law requires you to use the lower beam of your headlights.
   A. When parked on the side of highway and when approaching oncoming vehicles within 500 feet.
5. Mention three classes of vehicles which are required to stop before crossing a railway grade crossing.
   A. 1. Busses and omnibusses
   2. School busses
   3. Vehicles transporting explosives
   4. Vehicles transporting inflammable liquids such as gasoline.
6. What vehicles are required to carry flares?
   A. Busses and omnibusses (excepting taxicabs); every commercial motor vehicle, or combination thereof, having a carrying capacity of two tons or more.
7. When must you present your motor vehicle for compulsory inspection?

A. During the first three months of every inspection campaign when officially proclaimed by the Governor of Pennsylvania.

8. What must you do if you lose your operator's license, registration card, or registration plates?
   A. Apply, within forty-eight hours, to the Bureau of Motor Vehicles for a duplicate issue on form provided for that purpose.

9. Mention three places where it is unlawful to park along the open highway.
   A. 1. At any point where less than 15 feet of travelable portion of highway is left for free passage of other vehicles.
      2. At any point where a clear view of vehicle cannot be obtained from a distance of 200 feet from either direction.
      3. Along any highway excavation or obstruction, or opposite the same, where less than 20 feet remains for free passage of other vehicles.
      4. On the roadway side of any vehicle which is stopped at the edge of the highway.

10. What should you do if the rear wheels skid sideways on a slippery road?
    A. Turn front wheels in the direction of skid.

11. In descending a steep grade or a slippery or icy hill, what is the safest thing to do?
    A. Go into second or low gear, using the same gear which would be necessary to ascend the hill.

12. How should you apply your brakes to keep the car from skidding?
    A. Apply them intermittently with a 'pumping' motion.

13. Why is a slow moving vehicle in faster traffic an accident hazard?
    A. Because it requires each of the faster moving vehicles to pass it and encourages impatient motorists to take dangerous chances.

14. When overtaking and passing another vehicle which is safer—a short, quick turn—or a long, gradual swing?
    A. A long, gradual swing in order that traffic approaching from the other direction can be more easily seen and to avoid undue swerving which throws an unnecessary strain on both car and operator.

15. When slowing down on a slippery road do you disengage your clutch?
    A. No. Apply the brakes cautiously, leaving the clutch engaged.

16. Why is it necessary to reduce speed on a highway wet with rain or snow?
    A. Because the 'gripping' qualities of the tires are greatly reduced.

17. What must you do immediately upon the approach of an ambulance or fire or police apparatus responding to a call?
    A. Drive to the extreme right side of the highway, or street, and come to a full stop.

18. State three violations of the vehicle code which may result in suspension or revocation of operating privileges.
    A. 1. Driving while intoxicated
    2. Failure to stop at the scene of an accident
    3. Misstatement of facts on an application to the Bureau of Motor Vehicles
    4. Failure to report an accident as required by law
    5. Operating a motor vehicle without the permission of owner or custodian.

19. What is necessary as to motor and brakes when parking?
    A. Motor must be stopped and emergency brake should be applied.
    In parking on steep grades motor should be placed in gear so as to resist tendency of car to coast.

20. Under what two conditions are you permitted to pass a street car on the left?
    A. 1. On a one-way street
    2. When travelable portion of highway does not exist to the right.

21. How should you approach an intersection when about to make a left turn? A right turn?
    A. 1. Left turn must be made from right of center of highway excepting one-way streets when it is made from extreme left of highway.
    2. Right turn must be made from extreme right of highway.

22. Mention three places where it is unlawful to pass another vehicle which is travelling in the same direction.
    A. 1. When road is not clearly visible and free from oncoming traffic.
    2. When approaching crest of a grade or upon a curve where the driver's view is obstructed within 300 feet.
    3. At an intersection or grade crossing.
    4. Between temporary warning signs indicating that men are working on the highway.

23. How near may you park to an intersection? A fire hydrant?
    A. 1. 25 feet.
    2. 15 feet.

24. What two things must you do before starting, stopping or turning?
    A. 1. See that such movement can be made in safety.
    2. If any pedestrian may be endangered sound the horn and if any other vehicle is endangered, give a signal, plainly visible to the driver of the other vehicle. (The required signal may be given by extending the arm and hand or by electrical signal devices.)

25. What two things must you do upon signal being given by a vehicle which is about to pass you from the rear?

A. 1. Keep to the extreme right
2. Do not increase speed until overtaken

26. Name six items of standard equipment of a motor vehicle which the law requires you to keep in good condition.

A. 1. Headlamps
2. Rear lamps
3. Horn
4. Windshield and wiper
5. Brakes
6. Steering
7. Tires
8. Muffler

27. What is the speed limit while passing through a school zone?

A. 15 miles per hour.

28. Do pedestrians always have the right of way at marked intersections?

A. Yes.

29. Is it unlawful to coast down grade with the gear in neutral or clutch disengaged?

A. Yes.

30. What are the two requirements for lights on motor vehicles parked along the highway at night?

A. 1. Any lighted headlamps on a parked vehicle must be depressed or dimmed.
2. Any vehicle parked or stopped may display a parking light on the left side, showing green 500 feet to the front and red 500 feet to the rear instead of other specified lighting equipment.

31. Why should you concentrate on driving at all times while operating a car?

A. In order to be on the alert to meet *safely* any unforeseen conditions.

32. Mention two reasons for being required to furnish proof of financial responsibility.

A. 1. If operator's license has been suspended or revoked.
2. If operator has been involved in two or more accidents, within twelve months, aggregating $200.00 or more in claims for property damages or injuries sustained by other persons.

3. When a person fails to pay a final judgment (within fifteen days) of $200.00 or more resulting from a motor vehicle accident.

33. Why is an excessive speed more dangerous while driving at night than during the day?
    A. Because vision of the operator is restricted to that portion of the highway which is illuminated by headlamps and because very few headlamps permit a safe speed of greater than 40 miles per hour at night.

34. Why is it dangerous to repair a tire on the travelable portion of the highway?
    A. Because operators of other vehicles using the highway do not expect to find others using the highway as a repair shop. A person repairing a tire, at night, may stand in the way of the lights of his car, making it impossible for other motorists to see it.

35. What is the correct way to stop when signalled to do so by a police officer?
    A. Drive to the extreme right of the highway—giving signal of your intention.

36. Why is it unsafe to drive an automobile when you lack sufficient rest?
    A. Because mental and physical faculties are greatly impaired and one is unable to meet emergencies in a normal manner.

37. How close must your right wheels be to the curb when parked?
    A. Six inches.

38. When is a dirty windshield most dangerous?
    A. At sundown and at night.

39. How should you apply your brakes to keep your car under control in rounding a curve?
    A. Slow down before reaching the curve and apply brakes cautiously when rounding the curve, leaving the clutch fully engaged.

40. Mention three exceptions to the rule that a vehicle approaching an intersection from the right has the right of way.
    A. 1. When entering an intersection from a private road or driveway.
    2. Upon approach of police, ambulance or fire department vehicles.
    3. When entering a "THROUGH" highway or at a "STOP" intersection.

41. Even though you have the right of way at an intersection, what responsibility is placed upon you?
    A. To drive with due care and precaution for the safety of all persons using the highway and to refrain from arbitrary use of right of way.

42. What three things must you do when about to overtake and pass a vehicle?
    A. 1. Sound horn before overtaking.
    2. Make long, gradual swing in turning out.
    3. Observe overtaken vehicle in mirror before cutting back into line.

43. If you have to stop in going up hill, what must you guard against when you start out again? In starting what do you do?
    A. 1. Drifting backwards.
    2. Let out brake and clutch pedals gradually, meanwhile accelerating motor by using hand throttle.

44. What must you do while driving past children who are walking or playing along the highway?
    A. Keep car under control and be ready to make a quick, *SAFE* stop.

45. Where should your car be operated while passing an oncoming motor vehicle?
    A. To the right of the center of highway.

46. When does a Pennsylvania Operator's license expire?
    A. The last day of February of the year following the calendar year for which issued.

47. How must a rear view mirror be installed when required?
    A. So as to reflect a view of the highway for a distance of 200 feet to the rear.

48. Where should you stop your vehicle before entering a highway at which a "THRU TRAFFIC, STOP" sign is erected?
    A. Within a reasonable distance of the intersection at a point where approach of traffic can be readily observed, with due regard for the safety of pedestrians using the cross walk.

49. Must you come to a full stop before entering an intersection where a "THRU TRAFFIC, STOP" sign is erected, even though no traffic is approaching?
    A. Yes.

50. When about to pass a street car, must you wait until passengers who have alighted have reached the curb or side of highway?
    A. Yes.

51. What type of motor vehicle accidents must be reported to the Department of Revenue, Division of Safety, within twenty-four hours?
    A. Any motor vehicle accident resulting in injury or death to any person or total property damage to all cars or property involved to an apparent extent of $50.00 or more.

52. What three things must you do at the scene of an accident in which you are involved?
    A. 1. Stop immediately at the scene
    2. Disclose identity
    3. Render assistance to any person injured, including transportation of injured persons for medical or surgical treatment if it is apparent such treatment is necessary or if requested by injured.

53. What is the age limit of paid operators of trucks? Busses?
    A. 1. Eighteen 2. Twenty-one

54. How close may busses and trucks trail each other on the open highway?
    A. 500 feet.

55. What is the maximum length permitted a single commercial motor vehicle with load?
    A. Thirty-five feet.

56. What caution signals must be displayed during the day and at night on the end of load extending more than four feet to the rear of motor vehicle?
    A. Red flag not less than twelve inches square during the day and a red light, visible 500 feet to the rear, at night.

57. Why are additional lights required on trucks and busses?
    A. To indicate the presence of a large, slow moving vehicle.

58. What must you do upon changing your address?
    A. Notify the Bureau of Motor Vehicles at once on form provided by the Department.

59. What must you do before transferring registration plates from one vehicle to another?
    A. Make application upon proper form and forward same to the Bureau of Motor Vehicles.

60. Why must you sign your learner's permit, operator's license and registration card before operating on the highway?
    A. Because operation is unlawful until cards are signed by person to whom issued.

61. Is it lawful to permit anyone to ride on the running board or fenders or to hang on the rear of your car?
    A. No.

62. How must flares be displayed when a commercial vehicle is disabled along the highway at night?
    A. One at 100 feet to the front—one along roadway side, and one at 100 feet to the rear of the disabled vehicles.